

# Chemical Management

Los Alamos National Laboratory

Laboratory Implementation Requirements LIR 402-510-01.1

Issue Date: 12/23/99 (Revised 8/20/03)

Mandatory Document

## 1.0 Introduction

### 1.1 Overview

**Note:** [Click here](#) for lessons learned that may apply to the requirements contained in this Laboratory implementation requirement (LIR).

The contents of this LIR define the minimum set of requirements for chemical work, including the qualifications and training necessary for persons involved in chemical work, work approval and authorization, documentation for work, and a basic safe-work process. These requirements supersede Administrative Requirements 1-9, "Hazard Communication"; 6-1, "Chemicals"; 6-2, "Workplace Monitoring for Chemical, Physical, and Biological Hazards"; 6-4, "Biological Monitoring for Hazardous Materials"; 6-5, "Flammable and Combustible Liquids"; 6-9, "Safe Handling of Hazardous Gases"; Laboratory Standard (LS) 106-01.0, "Chemical Hygiene Plan"; LS 106-03.0, "Carcinogen Use", Notice 0031 "Requirement for Maintaining Automated Chemical Inventory Data", and Notice 0034 "Requirements for Disposal of Waste Sharps." The above requirements remain in effect until this LIR is implemented. This LIR complements the expectations contained in LPR 402-00-00, "Worker Health and Safety." The requirements contained in this LIR shall be effective 3 months from date of issue. Attachment 11 lists the "Recommended Implementation Criteria for Self-Assessment."

### 1.2 In This Document

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### 1.3 Flow Diagram

The flow diagram on p. 2 shall be implemented to enable users to determine which requirements are applicable to their operations and activities.

## 2.0 Purpose

This document defines the Laboratory's Chemical Management Program, which shall be implemented to protect worker health and safety, prevent pollution, assist Emergency Management and Response, protect the environment, and minimize waste by controlling chemical activities.

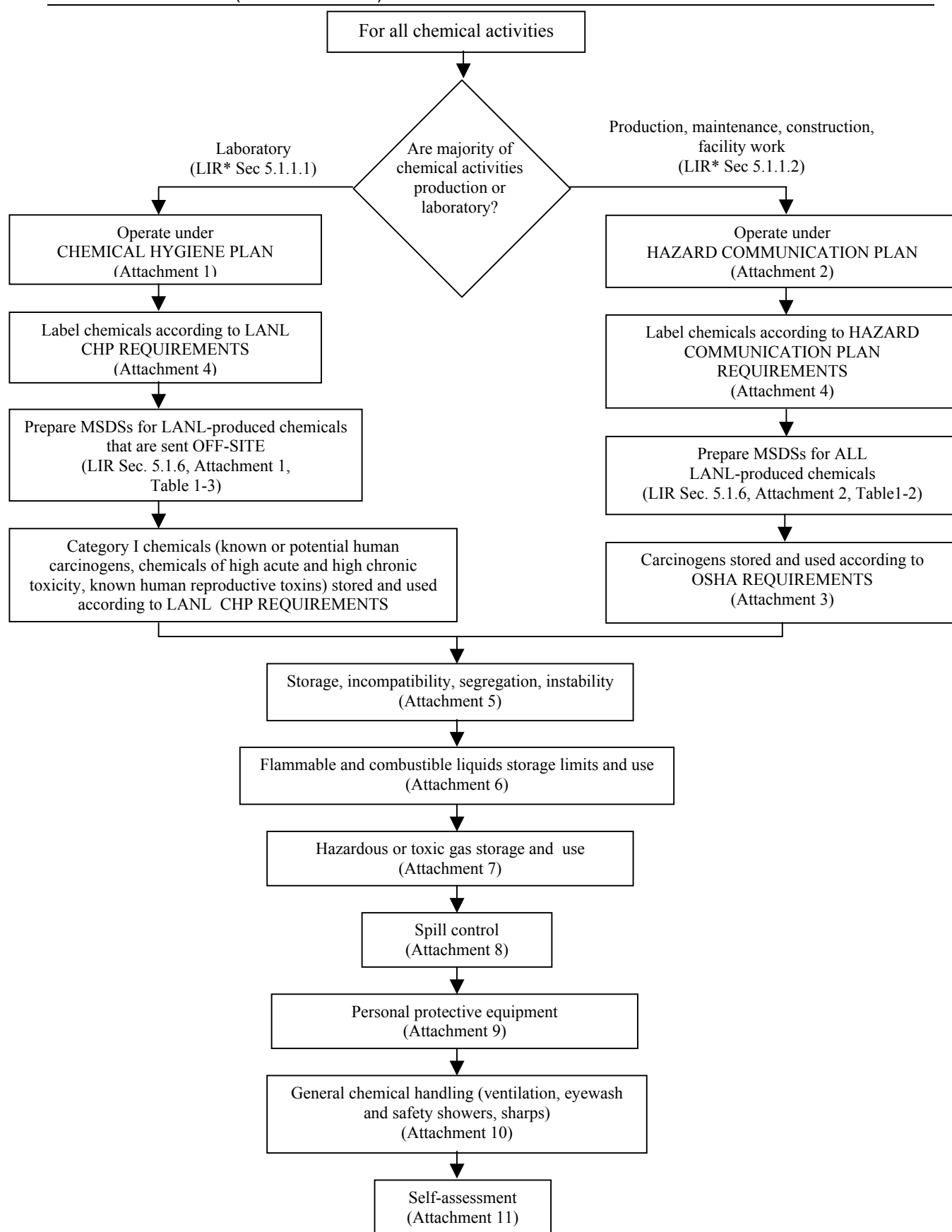
All workers at Los Alamos National Laboratory (Laboratory or LANL) shall implement these requirements to ensure a safe workplace and to promote safe handling, use, and storage of chemicals, including waste. These requirements shall be implemented to ensure that only workers qualified through education, training, and experience work with chemicals.

**Guidance Note:** Implementation of this LIR and its attachments meets the requirements of both the "Hazard Communication Standard" (29 CFR 1910.1200, "General Industry," and 29 CFR 1926.59, "Construction") and the "Occupational Exposure to Hazardous Chemicals in Laboratories" standard (29 CFR 1910.1450).

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Attachment 1, "Chemical Hygiene Plan" (CHP), and Attachment 2, "Hazard Communication Plan" (HAZCOM Plan), constitute the Laboratory's program. Individual organization's using chemicals shall use hazard control plans (HCPs), standard operating procedures (SOPs), and activity hazard analyses (AHAs), or the equivalent manuals or procedures that govern processes and equipment, etc., to supplement the referenced programs.

## 3.0 Scope and Applicability

This document shall apply to all work areas in which chemicals are manufactured, machined, handled, received, distributed, transported, used, or stored. Activities that shall be subject to the requirements contained in this LIR include maintenance, construction, research and development (R&D), and decontamination and decommissioning (D&D) of LANL facilities and equipment that involve the use of chemicals or the existence of chemical residues. Environmental restoration activities shall meet the requirements of the Laboratory HAZCOM Plan.

## 4.0 Definitions

### 4.1 Acronyms and Abbreviations

ACGIH	American Conference of Governmental Industrial Hygienists
ACIS	Automated Chemical Inventory System
AHA	Activity hazard analysis
ANSI	American National Standards Institute
AR	Administrative requirement
CAS	Chemical Abstract Service
CFR	Code of Federal Regulations
CHP	Chemical hygiene plan
D&D	Decontamination and decommissioning
DOE	US Department of Energy
DOT	US Department of Transportation
EM&R	Emergency management and response
EMP	Emergency management plan
ES&H	Environment, safety, and health
FM	Facility manager
HAZCOM	Hazard communication
HCP	Hazard control plan
HSR	Health, Safety, and Radiation (Division)
IARC	International Agency for Research on Cancer
ISM	Integrated safety management
LANL	Los Alamos National Laboratory
LEL	Lower explosive limit
LIG	Laboratory implementation guidance
LIHSM	Laboratory Industrial Hygiene and Safety Manual {(formerly known as ESH-5 Field Operations Manual (FOM))}
LIR	Laboratory implementation requirement
LS	Laboratory standard
MSDS	Material safety data sheet
NFPA	National Fire Protection Association
OEL	Occupational exposure limit
OSHA	Occupational Safety and Health Administration
PEL	Permissible exposure limit
PPE	Personal protective equipment
SAR	Safety analysis report
SOP	Standard operating procedure
STEL	Short-term exposure limit
TLV	Threshold limit value
TWA	Time-weighted average

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## 4.2 Terms

**Accident**—Any event, including, but not limited to, equipment failure, rupture of containers, or failure of engineering controls, that potentially creates a hazard through uncontrolled release of a hazardous chemical.

**Action level**—An exposure level calculated as an 8-hr TWA that initiates certain required activities, such as exposure monitoring, medical surveillance, training, and record keeping.

**Biological monitoring**—Systematic collection and analysis of a sample (such as blood, urine, hair, or breath) from workers who have been potentially exposed to hazardous materials.

**Biological toxin**—Poison or toxin generated by the tissue, venom, or product of microbial growth or degradation.

**Carcinogen**—Those chemicals that have been identified as carcinogens by the agencies listed below and that have a concentration equal to or greater than 0.1% (1,000 parts per million).

- ACGIH, either Category A1 (confirmed human carcinogen) or Category A2 (suspected human carcinogen).
- OSHA requirements specified in 29 CFR 1910, Subpart Z.
- Compounds that IARC has confirmed or identified as possible human carcinogens and those chemicals that the National Toxicology Program has identified as known to be carcinogenic or as chemicals that may reasonably be expected to be carcinogenic.

**Chemical hygiene**—A written program that consists of the Laboratory's "Chemical Hygiene Plan" (Attachment 1) and activity-specific documentation, such as HCPs, SOPs, and AHAs, which set forth guidance to protect workers from the dangers presented by hazardous chemicals used in a particular laboratory work area.

**Chemical inventory**—A written or electronic record of tracked chemicals at a work area by container, which includes the chemical name; CAS number; manufacturer; a bar code number; and information such as the size of container, material in the container, owner, and location by building and room number.

**Chemical owner**—A worker who is qualified as a chemical worker and to whom a container that contains a chemical on the chemical inventory is assigned.

**Chemical release**—Any spilling, leaking, pumping, pouring, emitting, emptying, discharging, injecting, escaping, leaching, dumping, or disposing of a chemical into the environment.

**Emergency response**—A response made by workers from outside the immediate release area or by other designated emergency responders (i.e., the Los Alamos County Fire Department and the Hazardous Materials Response Group) to an occurrence that results, or is likely to result, in an uncontrolled release of a hazardous substance.

**ESH qualified person**—An employee who has academic credentials or work experience in a relevant discipline, such as industrial hygiene or industrial safety, who has experience or training in conducting workplace exposure monitoring and in determining the hazards and consequences of exposure to chemicals.

**Hazard analysis documentation**—Documentation that includes, but is not limited to, one or more of the following: HCPs, AHAs, facility-specific health and safety plans, ES&H plans, SOPs, and SARs.

**Hazardous chemical**—Any chemical that presents a physical hazard or a health hazard, as defined below. If a hazardous chemical comprises 1% (0.1% for carcinogens) or greater of a compound or mixture, the compound or mixture must be treated as a hazardous chemical.

**Guidance Note:** For guidance in determining whether a chemical is hazardous, refer to Appendices A and B of the OSHA Hazard Communication Standard (29 CFR 1910.1200) or the "Chemical Guide to the OSHA Hazard Communication Standard" (Clansky1991).

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**Hazard communication plan**—A written program developed and implemented by the Laboratory or subcontractor, which consists of requirements listed in Attachment 2 (“Hazard Communication Plan”) and activity-specific documentation such as AHAs, SOPs, HCPs, or operating procedures that set forth requirements to protect workers from the dangers presented by hazardous chemicals used in a specific construction or production work area.

**Health hazard**—The risk presented by a hazardous chemical if there is evidence that acute or chronic health effects occur in workers exposed to that chemical. Health hazards are presented by chemicals categorized as

- carcinogens,
- chemical asphyxiants,
- chemicals that cause effects in organs (e.g., kidney, liver, lungs, nerves),
- corrosives,
- irritants,
- reproductive toxins,
- sensitizers,
- toxic or highly toxic agents, and
- NFPA rating of 2, 3, or 4 under fire conditions.

**High acute toxicity**—Substances that may be fatal or cause clinical damage to target organs as a result of a single exposure or exposures of short duration. High-acute-toxicity chemicals meet the following criteria: extremely toxic or highly toxic ratings when measured by the table of toxicity levels in the Hazard Communication Handbook (Dufour 1990) and a PEL or TLV of less than 0.1 ppm or ceiling limit of less than 1.0 ppm.

**High chronic toxicity**—Refers to substances that produce adverse effects in humans who suffer repeated exposures to those substances over a relatively prolonged period.

**Laboratory**—A facility in which relatively small quantities of hazardous chemicals are used.

**Laboratory-produced material**—A chemical or chemical mixture that is manufactured or synthesized by an operating group at the Laboratory.

**Material safety data sheet**—Written, printed, or electronically transmitted information on the hazards and properties of a particular material, including instructions for its safe use.

**Medical consultation**—A meeting between a worker having a suspected injury, illness, or exposure and a physician from the Occupational Medicine Group or from Los Alamos Medical Center (if after normal working hours) to determine the need for a medical examination.

**Medical surveillance**—A periodic occupational medicine evaluation that includes laboratory and diagnostic testing and a physical examination, with attention to the potential for exposure to specific hazardous chemicals.

**Occupational exposure limit**—The exposure limit used by the Laboratory is the lower of the PEL or TLV.

**Permissible exposure limit**—An OSHA definition, usually expressed as an 8-hr TWA, meaning an airborne contaminant concentration that must not be exceeded for any 8-hr work shift of a 40-hr work week.

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**Physical hazard**—A hazardous chemical is a physical hazard if there is scientifically valid evidence that it is categorized as a (an):

- combustible liquid,
- compressed gas,
- cryogen (see also LIR 402-580-01, "Cryogenic Fluids or Cryogenics"),
- explosive material,
- flammable material,
- oxidizer,
- organic peroxide,
- spontaneously combustible (pyrophoric) material,
- asphyxiant,
- unstable (reactive) material, or
- water-reactive material.

**Production**—An operation in which large quantities of a limited list of hazardous chemicals are used on a routine basis for synthesis, product manufacture, product preparation, dip tank or painting, solvent cleaning, photographic development, mechanical shops, construction, or maintenance activities.

**Qualified chemical worker**—A worker (University of California, contractor, subcontractor, student) whose immediate supervisor has determined that he/she has the skill, knowledge, and abilities to safely perform the work to which he/she is assigned.

**Regulated area**—An area where entry and exit are restricted and controlled.

**Reproductive toxins (known human)**—Substances that are known to have lethal effects on the fertilized egg, developing embryo, or fetus, or to cause teratogenesis (malformation) in the fetus.

**Guidance Note:** In addition, certain reproductive toxins may cause infertility in males and females. The Laboratory provides a voluntary Reproductive Health Hazard Program for workers. Upon request, the program provides a system for identifying and evaluating known and suspected chemical, physical, biological, and radiological hazards present in the work site that may adversely affect the health of a fetus. More information is available from the Occupational Medicine Group or the ESH qualified person.

**Safety-and-environmentally-responsible line management chain**—See the definition in "Integrated Safety Management" (LA-UR-98-2837).

**Short-lived**—Describes hazardous chemicals that are generated and then consumed or eliminated in a chemical process, operation, or experiment.

**Short-term exposure limit**—A limit usually defined as a 15-min TWA.

**Spill**—An unintentional release of a hazardous chemical, liquid or solid that creates a hazard because of quantity, physical properties, or toxicity.

**Subcontractor**—A party entering into a subcontract with the University of California.

**Threshold limit value**—An ACGIH limit that is usually expressed as an 8-hr TWA, meaning a time-weighted airborne contaminant "concentration for a normal 8-hr workday and a 40-hr work week, to which nearly all workers may be repeatedly exposed, day after day, without adverse effect."

**Toxic**—Refers to a material that has the ability to injure biological tissue.

**Toxicity**—A relative property of a chemical agent that refers to a harmful effect on some biologic mechanism and the condition under which this effect occurs.

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**Tracked chemical**—A solid, semisolid, liquid, or contained gas(es) that cannot be considered a finished item (e.g., fluorescent light tubes, lantern or smaller cell batteries, metal stock for machining) and that are either (1) regulated, (2) pose a health or physical hazard to workers or the public, or (3) have a significant cost associated with disposal of the chemical or the container once it has been consumed.

**Training**—A documented, organized presentation of information that responds to regulatory requirements and educational objectives.

**Use**—To package, handle, store, transfer, dispose, or cause to react with another agent.

**Worker**—Laboratory employee, affiliate, or visitor, as well as a vendor, work provider, or work provider employee, who performs or supervises facility work at the Laboratory.

## 5.0 Implementation Requirements

### 5.1 Elements of the Chemical Management Program

The elements of the Chemical Management Program shall be

- a written plan;
- chemical procurement;
- a current chemical inventory in ACIS;
- a carcinogen management program;
- labels and signs;
- MSDSs;
- exposure control;
- safe chemical storage meeting regulatory storage limits, segregation, and shelf life;
- facility-specific emergency response plan and spill control;
- safe transport of chemicals;
- waste minimization and disposal; and
- worker qualification and training.

#### 5.1.1 Written Plan

The facility or organization's written plan shall consist of a written chemical hygiene plan (Attachment 1) or hazard communication plan (Attachment 2).

##### 5.1.1.1 Chemical Hygiene Plan

To minimize the potential for exposure to hazardous chemicals. "Occupational Exposures to Hazardous Chemicals in Laboratories" shall apply to (1) laboratories engaged in laboratory-scale (small quantities used on a nonproduction basis) in which the containers used for reactions, transfers, and other handling of substance are designed to be easily and safely manipulated by one person; (2) work where multiple chemical procedures or chemicals are used; (3) the analytic procedures are not part of a production process nor in any way simulate a production process; and (4) "protective laboratory practices and equipment" are available and in common use.

- Most of the Laboratory, by definition, falls under the CHP (Attachment 1), thus this attachment sets forth the requirements that shall be implemented to minimize the potential for worker exposure to chemical hazards and to reduce the consequences of an exposure, should one occur. By necessity, the plan is general in nature. Additional hazard analysis and control documentation specific to an individual facility or organization must supplement the attachment, e.g., HCPs and operating procedures.
- The maximum allowable time for completion of the group/facility documents shall be 1 year from the date of issuance of this LIR.

**Guidance Note:** The document update may be accomplished during the normal review period.

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The requirements contained in this LIR shall have been met when the CHP (Attachment 1), together with an organization's HCPs, SOPs, operating manuals, or other documents that govern processes and equipment, has been implemented.

## 5.1.1.2 Hazard Communication Plan

The HazCom Plan shall apply to production facilities, operations, and locations in which

- products are made;
- routine operations are conducted;
- chemicals are used for product preparation (such as a dip tank or painting operation);
- personnel are engaged in construction, facility work, or maintenance; and/or
- chemical residues are present (such as those being cleaned up by the Environmental Restoration and Decontamination and Decommissioning programs).

The Hazard Communication Standard shall apply to any hazardous chemical known to be present in the workplace to an extent that employees may be exposed under normal conditions of use or in a predictable emergency. These plans shall include requirements for maintaining MSDSs, lists of hazardous chemicals, medical surveillance, and requirements for training workers on the hazards of the chemicals with which they work.

**Guidance Note:** Any routine operations in which most (more than 50%) of the work involves a finite list of hazardous compounds, e.g., detonator production, pit production, maintenance and construction, photographic development, and mechanical shops, fall under the Laboratory's HAZCOM Plan (Attachment 2). In general, the presence of a material in the workplace constitutes "use."

The requirements contained in this LIR shall have been met when the HAZCOM Plan (Attachment 2), together with an organization's HCPs, AHAs, and SOPs and operating manuals or other documents that govern processes and equipment, have been implemented.

## 5.1.2 Chemical Procurement and Current Chemical Inventory

Only personnel authorized by their supervisor and knowledgeable of the effects of hazardous chemicals shall procure and receive these chemicals. Credit cards shall not be used for purchasing chemicals. Chemicals shall be ordered separately from perishable and nonchemical items. If an item ordered on a purchase request is a chemical, it shall be marked as a chemical and must contain a clear statement on the form that specifies delivery to TA-3, SM-31 or main warehouse. Gas cylinders and bulk gases are received at the Compressed Gas Processing Center.

A current chemical inventory shall be maintained on the Laboratory-wide inventory system, ACIS, which includes the chemical name, CAS number, manufacturer, owner, and initial storage location by room number. If a chemical container is moved to another building, the information in ACIS must be updated. LANL's explosives inventory shall not be included in ACIS but is tracked in a separate system maintained by DX and ESA divisions.

Chemicals in secondary containers shall not be tracked except when the building inventory has reached 80% of the threshold quantity for the 280 chemicals listed in 40 CFR 68.130, "Chemical Accident Prevention." (This list can be found at <http://www.access.gpo.gov/nara/cfr/cfr-retrieve.html#page1> enter 40 CFR 68.130 into the search criteria click on retrieve) An e-mail shall be sent to the safety-and-environmentally-responsible line management chain when a chemical has exceeded the 80% threshold quantity in a building. EM&R personnel shall contact the line management chain of the building detailing the consequences and action required.

Chemicals on OSHA's Process Safety Management List shall be maintained in quantities below the threshold limit if at all possible. (This list can be found at <http://www.osha.gov/STLC/processsafetymanagement/index.html>). When the threshold quantity of these chemicals is met or exceeded, OSHA's Process Safety Management Standard (29 CFR 1910.119, Appendix A) shall be implemented.

The chemical owner shall apply an ACIS bar code if tracked chemicals are purchased or received from sources other than the in-house chemical vendor or are delivered directly to the user without a bar code. If a visitor brings chemical containers to the Laboratory, the host shall enter these chemicals in ACIS.

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The chemical owner shall be a qualified chemical worker. Individuals with appointments of less than 1 year, visitors, undergraduate and high school students shall not be chemical owners. The immediate supervisor for the latter classifications of workers shall be the chemical owner.

As bar-coded containers are emptied, they shall be marked as disposed in ACIS by the owner, group, division, or Industrial Hygiene and Safety Group. The Laboratory's annual inventory shall be completed by December 31 of each year.

**Guidance Note:** When a container is disposed, any remaining chemical becomes a waste.

The owner shall annually inspect all chemical containers to ensure that there is a need for the chemical, the container is in good condition, the chemical has not expired, and all labels are in good condition. An e-mail notification shall be sent to the chemical owner and group leader when it is time to check on a container that may have exceeded its shelf life.

The requirements contained in LIR 250-02-01, "Occupying or Vacating Workspace," shall be adhered to when the owner transfers to a different work location or leaves the Laboratory.

The Industrial Hygiene and Safety Group shall be contacted for assistance in determining inventory requirements. Appendix A provides a listing of ACIS functions and processes that shall be implemented for maintaining a chemical inventory. The Industrial Hygiene and Safety Group's peer review process shall be used to review hazards posed by chemicals to determine the chemical categories to be tracked on ACIS.

**Guidance Note:** The Laboratory's chemical management system is used to track chemicals (solid, semisolid, liquid, or contained gases) that cannot be considered finished items (e.g., fluorescent light tubes, lantern or smaller cell batteries, and metal stock for machining) and that are either (1) regulated; (2) pose a potential health or physical hazard to workers or the public; or (3) have a significant cost associated with disposal of the chemical or the container once the chemical has been consumed. In most cases, tracked chemicals arriving at LANL are packaged in primary containers (the original container with the manufacturer's label). However, other materials (metal ingots for smelting; sulfuric, nitric, and hydrochloric acid delivered to tanks; etc.) are also tracked. The following are some examples of chemicals that may meet the tracking criteria but will not be tracked by this system: water, sand, saline solutions, chemicals of biological origin (DNA, RNA, immunochemicals, antibodies, enzymes, peptides), explosives inside DX and ESA division boundaries that are tracked by these divisions, special nuclear material, and office supplies (whiteout, toner, marker board cleaner, ink, etc.).

## 5.1.3 Carcinogen Management Program

A carcinogen management program (see Attachment 3) shall be implemented and the carcinogen management requirements are included in the CHP (Attachment 1). Personnel in areas governed by the HAZCOM Plan (Attachment 2) shall implement Attachment 3 if carcinogens are being used.

**Guidance Note:** A current list of known and suspected human carcinogens can be found under the heading "Reference Lists" on the chemical management web page. (<http://int.lanl.gov/safety/chemical/index.shtml>)

## 5.1.4 Labels and Signage

All chemical containers shall be labeled per Attachment 4, "Signs and Labeling." Labels on incoming containers of hazardous chemicals shall not be removed or defaced if they still accurately define the contents. See Attachment 4 and LIR 402-100-01, "Signs, Labels, and Tags," for specific requirements that shall be implemented.

**Guidance Note:** LIR 402-100-01, "Signs, Labels, and Tags," provides guidance for hazard warning and control signs.

## 5.1.5 Material Data Safety Sheets

Workers must have access to MSDSs. A copy of the manufacturer's MSDS received with the first shipment of a chemical must be sent to the Industrial Hygiene and Safety Group if that container arrives without a bar code. In some cases, MSDSs must be generated for laboratory-produced materials whenever the composition of the chemical

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substance includes a hazardous chemical with hazardous chemical comprised of 1% or greater (0.1% for carcinogens). Whenever a mixture is formed, the MSDSs developed must include the chemical composition. The requirements for when MSDSs must be written for laboratory-produced chemicals differ, depending on whether the area is covered by a CHP or a HAZCOM plan. (See Attachments 1 and 2 for additional information.) The Industrial Hygiene and Safety Group's Toxicology Team shall be contacted for assistance in creating an MSDS.

**Guidance Note:** Electronic MSDSs are available on the chemical management web page under the heading "Requirements and Systems" (<http://int.lanl.gov/safety/chemical/index.shtml>)

## 5.1.6 Exposure Control

Facility equipment and work requirements shall be designed to meet the requirements contained in this LIR and to limit chemical exposures to a level below the OEL.

**Guidance Note:** The OEL is the more conservative (lower) value of either an OSHA PEL TWA (<http://www.osha.gov/SLTC/pel/index.html>) or an ACGIH (1997) TLV TWA, ceiling limit, or STEL.

The STEL shall not be exceeded at any time during a workday, even if the 8-hr TWA is within the PEL or TLV. The hierarchy listed in LPR 402-00-00, "Worker Health and Safety," shall be followed. See Attachment 9 for the PPE requirements and Attachment 10 for the ventilation requirements that shall be implemented.

## 5.1.7 Storage

Storage shall include bulk, tank, piping, cylinder, and container storage of solid, liquid, or gaseous chemicals. It shall include used and unused chemicals, laboratory-produced materials, those stored in partially filled containers and in containers other than original containers, and chemical "heels" left within tanks, piping, or containers. Incompatible compounds shall be segregated [see "Storage Incompatibility and Instability" (Attachment 5)]. Certain classes of hazardous materials have regulatory storage limits that shall be addressed [see "Flammable/Combustible Liquids Storage and Use" (Attachment 6) and "Hazardous/Toxic Gas Use and Storage" (Attachment 7)]. Since peroxide-forming and shock-sensitive compounds have a limited shelf life (Attachment 5), the safety-and-environmentally-responsible line manager shall determine a disposal plan for items having a short shelf life.

## 5.1.8 Emergency Response Plan

Facility- or building-specific emergency response plans must be prepared and include information on evacuation routes, spill control, and cleanup. Building emergency plans and site-specific emergency procedures requirements stated in LIR 403-00-01, "Los Alamos National Laboratory Emergency Management," and the building run sheets requirement from EMP 403-00-0, "Los Alamos National Laboratory Emergency Management Plan," together with Attachment 8, "Spill Control," shall constitute the facility or building emergency response plan.

## 5.1.9 Transportation Procedures

Required transportation procedures shall be followed in accordance with the requirements in LIR 405-10-01.0, "Packaging and Transportation."

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## 5.1.10 Disposal

All chemical disposal shall be performed in accordance with LIR 404-00-02, "General Waste Management Requirements," and LIR 404-00-03, "Hazardous and Mixed-Waste Requirements for Generators."

## 5.2 Worker Qualification Requirements

Responsible Individual	Shall
<b>Qualified Chemical Worker</b>	<ul style="list-style-type: none"><li>complete formal introductory HAZCOM (worker-right-to-know) training provided by HSR Division, which shall include how to detect hazards, how to interpret an MSDS, and labeling requirements.</li><li>complete facility-specific hazard training, when required.</li><li>be briefed on the following activities and topics: operation and building chemical inventory, obtaining an MSDS, establishing ownership of chemicals, secondary-container-labeling requirements, building signs and postings, building emergency plans, the CHP or HAZCOM plan, location of eyewashes and safety showers, spill response, and chemical storage requirements.</li><li>when required, complete on-the-job training on specific chemical hazards, procedures, and PPE and review the hazard analysis documentation for the job assignment (See Attachment 9, "Personal Protective Equipment," and Attachment 10, "General Chemical Handling," for additional information). On-the-job training must be completed whenever a worker receives a new job assignment or a new hazard is introduced into the current assignment.</li><li>meet the educational and experience requirements determined by the supervisor.</li></ul>

## 5.3 General Chemical Safety Requirements

The requirements in LIR 402-10-01, "Hazard Analysis and Control for Facility Work," or LIR 300-00-01, "Safe Work Practices," and LIR 300-00-02, "Documentation of Safe Work Practices," shall be implemented when they are relevant to chemical activities.

HCPs or AHAs or the equivalent operating manuals or procedures that govern processes and equipment shall be developed for all work with known and suspected human carcinogens, chemicals of high acute or high chronic toxicity, known human reproductive toxins, and explosives.

5.4 Responsibilities Responsible Individual	Shall
<b>Group Leader/ Immediate Supervisor</b>	<ul style="list-style-type: none"><li>ensure that all chemical work falls within the facility's operating limits.</li><li>determine what written program applies to each building, laboratory, etc., and record in supplemental documentation to the CHP or HAZCOM plan.</li><li>ensure implementation of all Chemical Management Program elements.</li><li>implement the requirements for the CHP or HAZCOM plan," whichever applies; write additional documentation, when required.</li><li>authorize qualified workers to perform chemical work.</li><li>authorize qualified workers as chemical owners.</li><li>ensure coordination between the FM, workers, and ESH qualified person so that engineering controls are maintained and chemical activities are evaluated.</li><li>ensure that purchasing chemicals, lab supplies, and safety equipment used in chemical work is conducted in accordance with the Procurement Group's (BUS-5) procurement requirements.</li><li>ensure that the following data contained in ACIS are maintained:<ul style="list-style-type: none"><li>updated information on the chemical owner and initial storage location for new chemical containers with ACIS bar codes.</li><li>change of the building location in ACIS when a chemical container is transferred.</li></ul></li></ul>

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	<ul style="list-style-type: none"> <li>- change of the chemical owner if the owner has changed.</li> <li>- change of the room location in ACIS on the annual inventory.</li> <li>• in ACIS, mark the bar code as disposed for empty or disposed containers or send the bar code to the Industrial Hygiene and Safety Group for system update.</li> <li>• add the tracked chemical in ACIS and apply a bar code obtained from the Industrial Hygiene and Safety Group when the container arrives without a bar code or send to the Industrial Hygiene and Safety Group other than the in-house chemical vendor and those that are delivered directly to the user, chemicals brought onsite by a visitor, and chemicals sent by a vendor as samples. Items brought in for the purpose of equipment service and repair and analytical samples shall be excluded from this requirement.</li> <li>• ensure that an annual chemical inventory update is recorded in ACIS.</li> <li>• obtain monitoring data from the ESH qualified person to determine whether the levels of chemical exposures to employees exceed the OEL.</li> <li>• inform new employees of the results of previous area/workplace monitoring.</li> <li>• ensure that hazardous chemicals are procured and received only by authorized personnel.</li> <li>• revoke chemical procurement authority for violations/abuse of chemical purchasing.</li> <li>• determine shelf life for unstable compounds and dispose of the chemical container and its contents in accordance with the requirements of LIRs 404-00-02 and 404-00-03 when that shelf life is exceeded.</li> <li>• coordinate chemical work with the affected division or group, as well as with other affected Laboratory organizations.</li> <li>• provide subcontractors with facility-specific information on the chemical hazards to which they may be exposed in the work areas and the protective measures that shall be implemented to reduce or eliminate worker exposure (see LIR 402-10-01, "Hazard Analysis and Control for Facility Work").</li> <li>• provide subcontractors with site- and facility-specific training.</li> <li>• disseminate information on the chemicals brought into the facility by subcontractors to which occupants could be exposed.</li> <li>• ensure that a medical exam is conducted when there is an incident/accident involving exposure or when a worker displays symptoms of potential exposure to chemicals.</li> <li>• ensure that required engineering controls and emergency equipment are installed and functioning as designed.</li> <li>• work with the FM to ensure that the building emergency plan, site-specific emergency plan and facility tenant agreement have been completed.</li> <li>• ensure that EM&amp;R and FM are notified of incidents.</li> </ul>
<b>Chemical Owner or Designee</b>	<ul style="list-style-type: none"> <li>• update ACIS records when the building location and owner change.</li> <li>• update ACIS when a tracked chemical is consumed or disposed.</li> <li>• annually evaluate all chemical containers to ensure that there is a need for the chemical.</li> </ul>
<b>Qualified Chemical Worker</b>	<ul style="list-style-type: none"> <li>• use required ventilation controls in accordance with the requirements in Attachment 10.</li> <li>• follow required administrative controls.</li> <li>• use, inspect, and wear required PPE. Maintain PPE in clean and ready-to- use condition.</li> <li>• assist in workplace monitoring and sample collection.</li> <li>• follow the requirements of the CHP or HAZCOM plan, AHAs, SOPs, and equivalent operating manuals or procedures.</li> <li>• report all chemical incidents to his/her supervisor and FM.</li> <li>• report to the Occupational Medicine Group immediately if a chemical- related illness or injury occurs.</li> </ul>
<b>Facility Manager</b>	<ul style="list-style-type: none"> <li>• coordinate facility chemical work with the affected division or group, as well as other affected Laboratory organizations.</li> <li>• provide facility subcontractors with facility-specific information on the chemical hazards to which they may be exposed and the protective measures recommended</li> </ul>

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	<p>to reduce or eliminate worker exposure (see LIR 402-10-01, "Hazard Analysis and Control for Facility Work").</p> <ul style="list-style-type: none"> <li>• provide facility subcontractors with facility-specific training.</li> <li>• disseminate information on the chemicals brought into the facility by facility subcontractors that could potentially expose occupants.</li> <li>• ensure that the appropriate facility-specific plan(s) (e.g., facility tenant agreement, building emergency plan, site-specific emergency procedures) is (are) written.</li> <li>• ensure that required facility engineering controls and emergency equipment are installed and function as designed.</li> </ul>
<b>Occupational Medicine Group</b>	<ul style="list-style-type: none"> <li>• provide medical surveillance.</li> <li>• request that an ESH qualified person conduct additional investigation if either a physician or patient has concerns about continued chemical use.</li> <li>• collect and analyze biological samples as required after real or suspected exposures to evaluate the health status of workers.</li> </ul>
<b>ESH Qualified Person</b>	<ul style="list-style-type: none"> <li>• conduct workplace evaluations in accordance with the Industrial Hygiene and Safety Group's LIHSM procedures. (The LIHSM is available electronically at <a href="http://int.lanl.gov/safety/lihsm/">http://int.lanl.gov/safety/lihsm/</a>)</li> <li>• notify the group leader, supervisor, worker, and the Occupational Medicine Group, in writing, of personal monitoring results.</li> <li>• determine whether biological monitoring is required and notify workers and responsible managers.</li> <li>• recommend control measures to be instituted to reduce the potential for worker exposure.</li> <li>• test local exhaust ventilation systems using calibrated and maintained equipment according to the Industrial Hygiene and Safety Group's LIHSM procedures for performance- testing local exhaust ventilation systems (available electronically at <a href="http://int.lanl.gov/safety/lihsm/">http://int.lanl.gov/safety/lihsm/</a>).</li> <li>• review work requests and coordinate design reviews with other groups for new construction or modifications of chemical storage and use facilities.</li> <li>• provide copies of all documentation of workplace evaluations, fume hood testing, and design reviews to the Industrial Hygiene and Safety Group.</li> </ul>
<b>Industrial Hygiene and Safety Group</b>	<ul style="list-style-type: none"> <li>• maintain chemical safety LIRs and LIGs, the Laboratory's CHP, the written HAZCOM plan, ACIS, and the MSDS hard-copy file and on-line system.</li> <li>• identify and ensure that the requirements of this LIR are incorporated in subcontracts.</li> <li>• verify the accuracy of ACIS data by conducting random spot checks throughout the Laboratory.</li> <li>• notify the chemical owner's division director when ACIS records are not being updated.</li> <li>• notify immediate safety-and-environmentally-responsible line managers by e-mail when a chemical listed in 40 CFR 68.130 has exceeded its 80% threshold quantity.</li> <li>• upon request, provide information on hazardous materials used or produced in Laboratory operations to members of surrounding communities.</li> <li>• review purchases of local exhaust equipment, including gloveboxes, hoods, exhaust fans, and air-cleaning devices.</li> </ul>
<b>ES&amp;H Training Group (PS-13)</b>	<ul style="list-style-type: none"> <li>• provide ES&amp;H training relevant to LANL LIRs.</li> </ul>
<b>Emergency Management and Response</b>	<ul style="list-style-type: none"> <li>• report to local, state, and federal agencies, as required.</li> <li>• coordinate emergency response.</li> <li>• work with the safety-and-environmentally-responsible line management chain and FMs to implement any additional requirements needed when a chemical listed in 40 CFR 68.130 has exceeded its 80% threshold quantity.</li> </ul>

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## 6.0 Documentation

### 6.1 Qualified Persons-

The qualified persons shall document assessment of personnel exposures to chemicals and provide documentation to HSR-5 as required by LIHSM chapters HSR-5-LIHSM-05 "Personal and Area Sampling for Air Contaminants" and HSR-5-LIHSM-01 "Worker Protection Qualitative Exposure Assessment"

Documentation of assessment of personnel exposures to chemicals shall be provided to HSR-5 as required by LIHSM Chapters HSR-5-LIHSM-05, "Personal and Area sampling for Air Contaminants" and HSR-5-LIHSM-01, "Worker Protection Qualitative Exposure Assessment."

### 6.2 Operating Organization

The owning division director or group office shall

- ensure that a copy of their own chemical inventory is available,
- maintain a record of calibration for testing equipment they own and maintain,
- ensure that access to the MSDS system is available to all chemical workers, and
- develop and complete an action plan for identifying and implementing corrective actions when noncompliance is identified and for new or revised chemical activities.

### 6.3 Occupational Medicine Group

The Occupational Medicine Group shall maintain records of medical consultations, medical examinations, and medical surveillance.

### 6.4 Industrial Hygiene and Safety Group

The Industrial Hygiene and Safety Group shall maintain the following records:

- worker and workplace exposure-monitoring records,
- calibration records for testing equipment it owns and maintains,
- performance-testing records for control measures,
- ACIS data, and
- Laboratory-wide MSDS file.

## 7.0 References

### 7.1 Document Ownership

The Industrial Hygiene and Safety Group, HSR-5, shall be the office of institutional coordination responsible for this document.

### 7.2 Referrals

Referrals shall be made to the Industrial Hygiene and Safety Group, 667-5231.

### 7.3 Documents

ACGIH (American Conference of Governmental Industrial Hygienists) 1997. "1997 TLVs and BEIs," Cincinnati, Ohio.

ANSI 1998. "American National Standard Institute Material Safety Data Sheets—Preparation," ANSI Z400.1, New York, New York.

The Book of Chemical Lists, Business and Legal Reports, Inc., August 1999.

Clansky, K., (Ed.) 1991. "Chemical Guide to the OSHA Hazard Communication Standard," Sixth Edition, Roytech Publications, Inc., Bethesda, Maryland.

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DOE Chemical Safety Web Page [http://tis-hq.eh.doe.gov/web/chem\\_safety/](http://tis-hq.eh.doe.gov/web/chem_safety/)

Dufour, J. T., et al., 1990. "Hazard Communication Handbook," California Chamber of Commerce.

EPA (Environmental Protection Agency). "Chemical Accident Prevention Threshold Quantities," 40 CFR 68.130, most recent edition, Washington, DC.

EPA (Environmental Protection Agency). Superfund Amendments and Reauthorization Act, 40 CFR 355, most recent edition, Washington, DC.

EPA (Environmental Protection Agency). "RCRA Acutely Hazardous Wastes, Toxic Wastes, and Land-Restricted Wastes," 40 CFR 261.33, most recent edition, Washington, DC.

LANL (Los Alamos National Laboratory). "LANL Integrated Safety Management," Los Alamos National Laboratory report LA-UR-98-2837, Los Alamos, New Mexico.

LANL (Los Alamos National Laboratory). "Occupying or Vacating Workspace," Los Alamos National Laboratory document LIR 250-02-01, most recent revision, Los Alamos, New Mexico.

LANL (Los Alamos National Laboratory). "Safe Work Practices," Los Alamos National Laboratory document LIR 300-00-01, most recent revision, Los Alamos, New Mexico.

LANL (Los Alamos National Laboratory). "Documentation of Safe Work Practices," Los Alamos National Laboratory document LIR 300-00-02, most recent revision, Los Alamos, New Mexico.

LANL (Los Alamos National Laboratory). "Stop Work and Restart," Los Alamos National Laboratory document LIR 401-10-01, most recent revision, Los Alamos, New Mexico.

LANL (Los Alamos National Laboratory). "Hazard Analysis and Control for Facility Work," Los Alamos National Laboratory document LIR 402-10-01, most recent revision, Los Alamos, New Mexico.

LANL (Los Alamos National Laboratory). "Los Alamos National Laboratory Emergency Management," Los Alamos National Laboratory document LIR 403-00-01, most recent revision, Los Alamos, New Mexico.

LANL (Los Alamos National Laboratory). "General Waste Management Requirements," Los Alamos National Laboratory document LIR 404-00-02, most recent revision, Los Alamos, New Mexico.

LANL (Los Alamos National Laboratory). "Cryogenic Fluids or Cryogenics," Los Alamos National Laboratory document LIR 402-580-01, most recent revision, Los Alamos, New Mexico.

LANL (Los Alamos National Laboratory). "Hazardous and Mixed Waste Requirements," Los Alamos National Laboratory document LIR 404-00-03, most recent revision, Los Alamos, New Mexico.

LANL (Los Alamos National Laboratory). "Worker Health and Safety," Los Alamos National Laboratory document LPR 402-00-00, most recent revision, Los Alamos, New Mexico.

OSHA (Occupational Safety and Health Administration). "Hazard Communication Standard," 29 CFR 1910.1200, most recent edition, Washington, DC.

OSHA (Occupational Safety and Health Administration). "Occupational Exposure to Hazardous Chemicals in Laboratories," 29 CFR 1910.1450, most recent edition, Washington, DC.

OSHA (Occupational Safety and Health Administration). "Process Safety Management Threshold Quantities," 29 CFR 1910.119, most recent edition, Washington, DC.

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## 8.0 Attachments

Appendix A "Required Sheet for Use of LANL's Automated Chemical Inventory System"

Attachment 1 "Chemical Hygiene Plan"

Attachment 2 "Hazard Communication Plan"

Attachment 3 "Carcinogen Management"

Attachment 4 "Signs and Labeling"

Attachment 5 "Storage Incompatibility and Instability"

Attachment 6 "Storing and Using Flammable and Combustible Liquids"

Attachment 7 "Use and Storage of Hazardous and Toxic Gases"

Attachment 8 "Spill Control"

Attachment 9 "Personal Protective Equipment"

Attachment 10 "General Chemical Handling" (engineering controls, ventilation, eyewashes and safety showers, sharps)

Attachment 11 "Recommended Major Implementation Criteria for Chemical Management LIR Self-Assessment"

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## APPENDIX A

### REQUIRED SHEET FOR USE OF LANL'S AUTOMATED CHEMICAL INVENTORY SYSTEM

Each tracked chemical container at LANL that has an Automated Chemical Inventory System (ACIS) bar code shall be entered as a record in ACIS. Each record shall contain information about the container's chemical content [name, Chemical Abstract Service (CAS) number, amount, manufacturer, and catalog number]; location (technical area, building, room, and location comments); and ownership (group, owner's name, and owner's Z- number). The building location and owner shall be kept current.

Viewing and updating ACIS data shall require the stated ACIS authority. Chemical owners at LANL shall have full viewing and updating authority only over chemical containers in their ownership. To gain authority over all the containers in a group (ACGRP), the group leader shall grant ACGRP. Access to other groups' inventory information shall require ACGRP authority granted by the group leaders of those groups. Access to an entire division's containers shall require an e-mail from that division office to [acis@lanl.gov](mailto:acis@lanl.gov), requesting that this level of authority be granted. In special circumstances, the authority for viewing all the containers at LANL shall only be granted by e-mailing [acis@lanl.gov](mailto:acis@lanl.gov) with the specific reason for needing access.

If questions, comments, or concerns regarding ACIS arise, the ACIS administrator in the Industrial Hygiene and Safety Group shall be contacted at 7-9242 or by e-mail at [acis@lanl.gov](mailto:acis@lanl.gov).

**Guidance Note:** The Industrial Hygiene and Safety Group has provided a web interface <http://acis.lanl.gov> that allows access to ACIS data for authorized users. The system requires the use of Netscape Communicator 4.6, or higher, or Microsoft Internet Explorer 4.0, or higher, to accommodate newer web features. A smart card will also be needed to use this system. Information on obtaining a smart card can be found at <http://www.lanl.gov/orgs/cic/cic6/smartcards.html> or by contacting the Labwide Systems Office (505-665-4444, Option 2). The ACIS home page offers several main functions that help chemical owners maintain their inventory data.

TABLE 1

ACIS FUNCTIONS (Guidance)

Non-Mandatory

Function	Capability
<b>Reporting</b>  Run a query from several parameters to obtain a report or data set.	Allows output in several formats, including Microsoft Excel.
<b>Add a Container</b>	Allows chemical owners to add chemical containers to ACIS that do not already have a LANL ACIS bar code. (Request LANL ACIS bar codes from the Industrial Hygiene and Safety Group's ACIS administrator at 7-9242 or by e-mail at <a href="mailto:acis@lanl.gov">acis@lanl.gov</a> .)
<b>Update a Container</b>	Allows chemical owners to update the information on a container that has a LANL ACIS bar code.
<b>Surplus and Disposed Containers</b>	Allows chemical owners to mark containers as surplus for internal recycling and to mark containers as disposed when their contents have been consumed.
<b>Perform Annual Inventory</b>	Allows chemical owners to perform an inventory on an annual or more frequent basis.
<b>Accept</b>	Allows chemical owners to accept new ACIS records transferred to their ownership.
<b>Transfer</b>	Allows chemical owners to initiate the transfer of an ACIS record from their ownership to another's ownership.

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TABLE 2

## MAIN PROCESSES IN MAINTAINING A CHEMICAL INVENTORY

Process	Actions
<b>Update Container Location</b>	<ul style="list-style-type: none"><li>As new chemicals arrive at LANL and pass through the ACIS receiving operation, they shall receive an ACIS bar code. When these bar-coded containers are delivered to the drop point, the information on the actual location is incomplete, thus, this information shall be updated with the current storage location (TA, building, room) and, when required, shall be augmented with other information (e.g., outside location, dock, refrigerator, flammable cabinet, Cabinet 1).</li><li>Using the Update a Container option, the TA, building, and room information shall be entered with current information.</li></ul>
<b>Update Container Ownership</b>	<ul style="list-style-type: none"><li>When bar-coded containers are delivered to the drop point, the ownership information is incomplete, thus, this information shall be updated with the current chemical owner and owner organization.</li><li>Using the Transfer and Accept functions, the chemical owner and owner group shall be entered.</li></ul>
<b>Disposed or Surplus Containers</b>	<ul style="list-style-type: none"><li>When the chemical contents of a container have been consumed or disposed, the bar code record on ACIS shall be updated from active status to disposed status.  <b>Guidance Note:</b> If a bar-coded container is not empty but is no longer needed, the ACIS record can be updated to show this container as surplus. This step allows other LANL employees to browse for surplus chemicals that they may be able to use instead of purchasing more.</li><li>Using the Surplus/Disposed Containers option, single or multiple containers shall be updated as surplus or disposed.</li></ul>
<b>Perform Annual Inventory</b>	<ul style="list-style-type: none"><li>A chemical inventory shall be performed on an annual or more frequent basis.</li><li>Using the Perform Annual Inventory option, the location parameters (TA, building, room) shall be entered to obtain a list of chemical containers. On this list, the box next to the bar codes for containers still at that location shall be checked, which will update the inventory date on those records to the current date. Bar-coded items in the room but not on the list shall have the location information updated through the Update a Container option. When the room inventory is complete, the same location parameters shall be entered using the Surplus/Disposed Containers option, and the inventory date used shall be the day the inventory was performed.</li></ul>

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## ATTACHMENT 1

### CHEMICAL HYGIENE PLAN

#### 1.0 Introduction

This attachment shall be the method of completing the requirement for a written plan given in LIR 402-510-01.0, "Chemical Management." The Chemical Hygiene Plan (CHP) shall set forth the requirements, which, when implemented, will minimize the potential for worker exposure to chemical hazards and reduce the consequences of an exposure, should one occur.

"Occupational Exposures to Hazardous Chemicals in Laboratories," 29 CFR 1910.1450, shall apply to laboratories engaged in laboratory-scale work when multiple chemical procedures or chemicals are used, when the analytic procedures are not part of a production process or in any way simulate a production process, and when "protective laboratory practices and equipment" are available and in common use to minimize the potential for exposure to hazardous chemicals.

Most of the Laboratory shall by definition, fall under 29 CFR 1910.1450, which requires the Chemical Hygiene Plan. However, hazard communication plans (HAZCOM plans) shall apply to production facilities or operations and to locations in which

- products are made;
- routine operations are conducted;
- chemicals are used for product preparation (such as a dip tank or painting operation);
- personnel are engaged in construction, facility work, or maintenance; and/or
- chemical residues are present (such as those being cleaned up under the Environmental Restoration and Decontamination and Decommissioning programs).

Any routine operations in which most (more than 50%) of the work involves a finite list of hazardous compounds (e.g., detonator production, pit production, maintenance and construction, photographic development, and mechanical shops) shall meet the requirements contained in the Laboratory's "Hazard Communication Plan" (Attachment 2).

This CHP and additional hazard analysis and control documentation specific to an operation, organization, or activity shall supplement this Attachment 1. Examples shall be, but are not limited to, hazard control plans and operating procedures.

The maximum allowable time for completing group/facility documents shall be 1 year from the date of issuance of this LIR 402-510-01.0; however, the group/facility documents may be updated during the normal review period.

#### 2.0 Purpose

The purpose of the CHP and the required additional hazard documentation shall be to document the measures used to prevent unacceptable exposure to hazardous chemicals in laboratories.

#### 3.0 Scope

The requirements contained in this attachment shall be implemented by the safety-and-environmentally-responsible line management chain to minimize chemical exposures; avoid underestimation of the risk; institute a chemical hygiene program; and use engineering controls, including ventilation, to observe occupational exposure limits (OELs) and threshold limit values (TLVs).

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## 4.0 Definitions

### 4.1 Acronyms

CFR	Code of Federal Regulations
CHP	Chemical hygiene plan
DOT	US Department of Transportation
EM&R	Emergency Management and Response (Group)
EPA	Environmental Protection Agency
ES&H	Environment, safety, and health
HSR	Health, Safety, and Radiation (Division)
FM	Facility manager
FOM	Field Operations Manual (Industrial Hygiene and Safety Group)
HAZCOM	Hazard communication
HCP	Hazard control plan
HEPA	High-efficiency particulate air (filter)
MSDS	Material data safety sheet
NFPA	National Fire Protection Association
OEL	Occupational exposure limit
OSHA	Occupational Safety and Health Administration
PEL	Permissible exposure limit
PPE	Personal protective equipment
SOP	Standard operating procedure
TA	Technical area
TLV	Threshold limit value

### 4.2 Definitions

**Category I chemical**—A Laboratory designation identifying specific chemicals that are regulated at the Laboratory and that require the user to follow special provisions. Category I chemicals are known human carcinogens, chemicals of high acute or high chronic toxicity, and known human reproductive toxins.

**Chemical hygiene officer**—A worker, qualified by training or experience and designated by the operating group or division, who provides technical guidance in implementing the CHP.

**Designated area**—An area that shall be used for work with Category I chemicals and to which access is restricted to authorized personnel.

**Laboratory-produced material**—A chemical or chemical mixture that is created or synthesized by an operating group at the Laboratory.

**Laboratory scale**—Work with hazardous chemicals in which the containers used for preparations, reactions, transfers, and other handling are designed to be easily and safely manipulated by one person.

**Reactive chemical**—A reactive chemical is one that

- is described as such by Bretherick (1990) or in the MSDS;
- is ranked by the NFPA as 3 or 4 for reactivity;
- is identified by the DOT as an oxidizer, an organic peroxide, or an explosive, Class A,B, or C;
- fits the OSHA definition: "Unstable (reactive)" means a chemical which is the pure state, or as produced or transported, will vigorously polymerize, decompose, condense, or will become self- reactive under conditions of shocks, pressure or temperature" (29 CFR 1910.1450).

**Secondary container**—Any chemical container other than an original container that will be used by more than one person or will be used beyond a single workday.

**Toxicity evaluation**—Determination of the toxic potential of a material by analyzing existing toxicity data, by assessing structure-activity relationship, or by extrapolating from toxicity data on a similar substance.

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## 5.0 Worker Qualification Requirements

Table 1-1 depicts the requirements that shall be met to qualify an individual as a chemical worker.

TABLE 1-1

### WORKER QUALIFICATION REQUIREMENTS

Individual	Shall
Chemical Hygiene Officer	<ul style="list-style-type: none"><li>• Meet the chemical worker qualification requirements.</li><li>• Have the education or experience to determine the hazards and consequences of exposure to the chemicals found on the chemical inventory.</li></ul>
Qualified Chemical Worker	<ul style="list-style-type: none"><li>• Meet the requirements in LIR 402-510-01. Have completed formal introductory hazard communication training (worker right-to-know) provided by HSR Division.</li><li>• Have completed facility-specific hazard training.</li><li>• Have been briefed by his/her supervisor on operations and the building's chemical inventory, how to obtain an MSDS, secondary container labeling requirements, building signs and postings, building emergency plans, the CHP, and spill response and chemical storage requirements.</li><li>• Have completed on-the-job training on specific chemical hazards, procedures, and PPE and have reviewed the hazard analysis documentation authorized by his/her supervisor or have read and understood the HCP for the job assignment. On-the-job training must be completed whenever a worker receives a new job assignment or a new hazard is introduced into the current assignment.</li><li>• Meet the education and experience levels determined by his/her supervisor.</li></ul>

## 6.0 CHP-Specific Responsibilities

General chemical and hazardous materials safety responsibilities that shall be implemented have been listed in LIR 402-510-01. OSHA-required CHP-specific responsibilities that shall be implemented are listed in Table 1-2.

TABLE 1-2

### CHP RESPONSIBILITIES

Individual	Shall
Safety-and-Environmentally-Responsible Line Managers	<ul style="list-style-type: none"><li>• Implement this CHP.</li><li>• Appoint a group or division chemical hygiene officer.</li><li>• Ensure that an annual chemical inventory update of purchased or produced chemicals (specifying owner, building, and room) is completed on ACIS by December 31 of each year.</li><li>• Ensure that the inventory is compared with the Category I list maintained by the Industrial Hygiene and Safety Group.</li><li>• Identify all Category I chemicals in use and establish designated work areas in which they are to be used. Access shall be restricted to authorized personnel and posted in accordance with Table 1-3.</li><li>• Ensure that containment devices such as fume hoods or glove boxes are available and used and that prescribed restrictions for conditionally approved engineering controls are implemented (see Attachment 10).</li><li>• Inform employees of exposure measurements.</li><li>• Provide additional engineering controls and PPE when employee exposure exceeds the OEL.</li><li>• Implement the OSHA-regulated substance standard when the OEL or PEL is routinely exceeded.</li><li>• Determine a disposal plan for shock-sensitive and peroxide-forming materials and include the plan in the HCP.</li></ul>

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	<ul style="list-style-type: none"> <li>• Ensure that employees receive a medical consultation when a chemical exposure has taken place or is suspected based on signs and symptoms.</li> <li>• Ensure that a spill response plan has been written.</li> </ul>
<b>Chemical Hygiene Officer</b>	<ul style="list-style-type: none"> <li>• Provide technical assistance to the group in implementing the Laboratory's CHP.</li> <li>• When requested, assist the safety-and-environmentally-responsible line manager in developing hazard analysis documentation for hazardous operations or activities such as those involving Category I chemicals.</li> </ul>
<b>Supervisors Who Approve Safe Work Practices That Involve Chemical Work</b>	<ul style="list-style-type: none"> <li>• Identify workers who in the course of their work may be exposed to hazardous chemicals, including, but not limited to, Category I chemicals and OSHA-regulated chemicals.</li> </ul> <p><b>Guidance Note:</b> The Laboratory provides a Reproductive Health Hazard Program for employees. Upon request, the program provides a system for identifying and evaluating known and suspected chemical, physical, biological, and radiological hazards present in the work site that may adversely affect the health of a fetus. More information is available from the Occupational Medicine Group or the ESH qualified person.</p> <ul style="list-style-type: none"> <li>• Implement the requirements of the Laboratory's CHP and any hazard analysis documentation and other prescribed procedures.</li> <li>• Provide inspections of designated areas, storage areas, housekeeping, and emergency equipment. Emergency equipment shall include portable fire extinguishers and eyewash and safety showers.</li> <li>• Ensure that the facilities and training for use of a material being ordered meet established requirements.</li> <li>• Ensure that the ventilation system and other protective equipment are functioning as required.</li> <li>• Ensure that access to eyewash and safety showers is not restricted in any way, that eyewash and safety showers are checked by releasing water periodically, and that this equipment is functioning as required. See Attachment 10.</li> <li>• Determine required control measures and PPE for each operation and ensure that required PPE is available and in working order (see Attachment 9).</li> <li>• Ensure that respiratory protection is not used in lieu of required engineering controls.</li> <li>• Ensure that workers have had the required training.</li> <li>• Ensure that EM&amp;R and the FM are notified of chemical incidents.</li> </ul>
<b>Qualified Chemical Worker</b>	<ul style="list-style-type: none"> <li>• Maintain qualification by meeting the formal classroom chemical safety training requirements stated in LIR 402-510-01, the Laboratory's CHP, and operation and activity HCPs, SOPs, and equivalent operating manuals or procedures.</li> <li>• Read MSDSs for chemicals used. (Electronic MSDSs are available at <a href="http://int.lanl.gov/safety/chemical/index.shtml">http://int.lanl.gov/safety/chemical/index.shtml</a>)</li> <li>• Review literature to determine the hazards of a chemical.</li> <li>• Treat a chemical of unknown composition as a hazardous substance.</li> <li>• Keep the quantity of chemicals stored in a laboratory to a level that is consistent with work in progress.</li> <li>• Use required engineering controls.</li> <li>• Use required PPE. See Attachment 9 for more details.</li> <li>• Plan and conduct each hazardous chemical operation in accordance with the CHP.</li> <li>• When working with flammable chemicals, identify all ignition sources and address the controls in an HCP.</li> </ul>
<b>ESH Qualified Person</b>	<ul style="list-style-type: none"> <li>• By means of personal or area sampling, monitor workplace with calibrated and maintained equipment as required to determine worker exposure conditions and that exposures are kept below the OEL. (See the Industrial Hygiene and Safety Group's LIHSM at <a href="http://int.lanl.gov/safety/lihsm/">http://int.lanl.gov/safety/lihsm/</a>)</li> <li>• Test local exhaust ventilation systems and fume hoods using calibrated and maintained equipment according to the Industrial Hygiene and Safety Group's LIHSM. (<a href="http://int.lanl.gov/safety/lihsm/">http://int.lanl.gov/safety/lihsm/</a>)</li> </ul>

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<b>PS Training Group</b>	<ul style="list-style-type: none"> <li>Provide introductory CHP training as part of introduction to hazard communication training.</li> </ul>
<b>Industrial Hygiene and Safety Group</b>	<ul style="list-style-type: none"> <li>Annually review and update this CHP and Category I list.</li> </ul>

## 7.0 General Requirements

Table 1-3 lists the minimum requirements of 29 CFR 1910.1450 that shall apply to the Laboratory.

**TABLE 1-3**

### MINIMUM REQUIREMENTS OF LANL'S CHEMICAL HYGIENE PLAN

<b>Topic</b>	<b>Minimum Requirements</b>
<b>Written Program</b>	<ul style="list-style-type: none"> <li>A CHP and its supplemental documentation outline shall be the means of protecting employees from health hazards associated with hazardous chemicals. This CHP and its supplemental documentation shall be readily available to employees.</li> <li>Implementing the requirements contained in LIR 300-00-01.0, "Safe Work Practices"; LIR 300-00-02.0, "Documentation of Safe Work Practices"; and LIR 205-02-01.0, "Occupying or Vacating Work Space," ensures the protection of employees who work in areas governed by this CHP. Each of the following elements must be addressed in operation- or activity-specific procedures and HCPs in which hazardous materials are used. <ul style="list-style-type: none"> <li>The circumstances under which a particular laboratory operation, procedure, or activity require prior approval.</li> <li>Provisions for medical consultation and examinations, as described below.</li> <li>Provisions for work with particularly hazardous Category I substances, which have a high degree of acute toxicity (List available from the Industrial Hygiene and Safety Group's Toxicology Team, 7-2854) (<a href="#">click here</a> for link to LIRs).</li> </ul> </li> </ul>
<b>Basic Rules and Procedures</b>	<ul style="list-style-type: none"> <li>Toxic substances shall be segregated in a well-identified area equipped with local exhaust ventilation.</li> <li>Chemicals that are highly toxic shall be kept in the original container or be placed in unbreakable, compatible secondary containers.</li> <li>Stored chemicals shall be examined at least annually to determine the need for replacement, degree of deterioration, and container integrity.</li> <li>Chemicals shall not be used unless the available ventilation meets requirements for the hazard and quantity to be used.</li> </ul>
<b>Training</b>	See worker qualification requirements, Table 1-1.
<b>Engineering Controls</b>	<ul style="list-style-type: none"> <li>Engineering controls, such as laboratory hoods, enclosed operations, and substitution of low-toxicity materials, must be the first level of protection. When engineering controls are not feasible or operations are temporary, or when an additional level of protection is required, respiratory protective equipment shall be used. The ESH qualified person shall be contacted for assistance in making this determination.</li> </ul>
<b>Determination and Evaluation of Employee Exposure</b>	<ul style="list-style-type: none"> <li>Current and proposed uses of hazardous chemicals must be assessed to determine the potential for workplace exposure. The criteria to be used in determining the adequacy of control shall include whether airborne exposures exceed established limits and whether dermal exposure causes skin injury or absorption of toxic quantities. All operations involving Category I chemicals and specific OSHA-regulated chemicals (list available from The Industrial Hygiene and Safety Group's Toxicology Team, 7-2854) (<a href="#">click here</a> for link to LIRs) shall be evaluated to determine monitoring requirements. Factors to be considered in determining exposure potential shall include <ul style="list-style-type: none"> <li>quantity used and frequency of use outside of fume hood,</li> <li>open container vs. covered systems and potential for airborne exposure,</li> <li>exposure controls currently in place,</li> <li>established occupational exposure limits,</li> </ul> </li> </ul>

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Topic	Minimum Requirements
	<ul style="list-style-type: none"> <li>- toxicological information on the substance, and</li> <li>- handling precautions and hazards indicated on the manufacturer's MSDS.</li> </ul> <p>When working with Category I substances, additional employee protection shall be required. (See Designated Areas and Decontamination sections of this table.)</p>
<b>Designated Areas</b>	<ul style="list-style-type: none"> <li>• A designated area (generally a fume hood or glove box but possibly a specially designed laboratory) shall be used in handling Category I chemicals, especially when the exposure limits for those chemicals are below 1 ppm or 0.5 mg/cm<sup>3</sup> of air. Access shall be restricted to authorized personnel only. Designated work areas must be posted indicating the hazard warning and control signs and the established required special work procedures. (See LIG 402-100-01, "Signs, Labels, Tags.")</li> </ul>
<b>Chemical Storage</b>	<ul style="list-style-type: none"> <li>• Chemical Storage shall consist of: <ul style="list-style-type: none"> <li>- segregating incompatible chemicals (see Attachment 5);</li> <li>- keeping quantities of stored flammable/combustible liquids within regulated limits (see Attachment 6);</li> <li>- segregating hazardous/toxic gases (see Attachment 7); and,</li> <li>- observing shelf life limits for shock-sensitive materials (see Attachment 5)</li> </ul> </li> </ul>
<b>Medical Consultation</b>	<ul style="list-style-type: none"> <li>• Employees shall have an opportunity to receive the following medical attention: <ul style="list-style-type: none"> <li>- a medical examination when the employee develops signs or symptoms associated with a hazardous chemical to which the employee may have been exposed;</li> <li>- medical surveillance when monitoring shows an exposure level routinely above the OSHA action level (or, in the absence of an action level, the PEL) for chemicals subject to monitoring and medical surveillance requirements;</li> <li>- a consultation to determine the need for an examination in the event of a spill, leak, explosion, or other occurrence that is likely to have caused a hazardous exposure.</li> </ul> </li> <li>• Medical examinations shall be performed by or under the direct supervision of a licensed physician and shall be provided without cost, loss of pay, etc., to the employee. The physician must be provided with the following information: <ul style="list-style-type: none"> <li>- the identity of the hazardous chemical to which the employee was exposed,</li> <li>- a description of the conditions under which the exposure occurred (including any available quantitative exposure data), and</li> <li>- a description of the signs and symptoms of exposure that the employee is experiencing, if any.</li> </ul> </li> <li>• The physician must provide a written opinion that includes the following: <ul style="list-style-type: none"> <li>- recommendation for further medical follow-up,</li> <li>- the results of the examination and any associated tests,</li> <li>- any medical condition revealed in the course of examination that might place the employee at increased risk to hazardous chemicals found in the workplace, and</li> <li>- a statement that the employee has been informed of the results of the medical examination and any medical condition that may require further examination or treatment.</li> </ul> </li> </ul>
<b>Decontamination of Designated Areas</b>	<ul style="list-style-type: none"> <li>• Decontamination for Category I materials shall not be required daily. It shall be necessary before the affected work area can be released from "designated area" status. Procedures for decontamination shall be included in the HCPs for the operations in which Category I chemicals are used. After decontamination, the area shall no longer be considered a "designated area," and all warning and control signs shall be removed.</li> <li>• A wet mop or a vacuum cleaner equipped with a HEPA filter shall be used instead</li> </ul>

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Topic	Minimum Requirements
	of dry sweeping.
Review/Update	<ul style="list-style-type: none"><li>The effectiveness of the CHP must be reviewed annually and updated as required based on the work.</li></ul>
Labels on Incoming Containers of Hazardous Chemicals	<ul style="list-style-type: none"><li>Labels shall not be removed or defaced (see Attachment 4) if they still accurately define the contents.</li></ul>
Labels on Containers Leaving the Workplace	<ul style="list-style-type: none"><li>Each container of hazardous chemicals shall be labeled, tagged, or marked with<ul style="list-style-type: none"><li>the identify of the hazardous chemicals,</li><li>required hazard warnings, and</li><li>the name and address of manufacturer, importer, or other responsible individual.</li></ul></li></ul> <p>(See Attachment 4 and LIR 405-10-01, "Packaging and Transportation.")</p>
Labels on Secondary Containers	<ul style="list-style-type: none"><li>The chemical name and owner shall appear on the label.</li></ul>
MSDS	<ul style="list-style-type: none"><li>LANL shall maintain any MSDSs received with incoming shipments of hazardous materials and shall ensure that they are readily accessible to employees during each work shift in their work areas. (The Industrial Hygiene and Safety Group shall maintain the hard copy and the on-line MSDS file for the Laboratory.)</li><li>An MSDS must be provided to distributors and other employers who use laboratory-produced chemicals.</li><li>If the chemical substance is produced for a user outside the Laboratory, LANL shall implement the Hazard Communication Standard (29 CFR 1910.1200) (see Attachment 2). MSDSs must be generated for laboratory-produced materials whenever the composition of the chemical substance is a hazardous chemical and the material is produced for a user outside of the Laboratory. Whenever a mixture is formed, the MSDSs developed must include the chemical composition if greater than 1% (0.1% for carcinogens). The Industrial Hygiene and Safety Group's Toxicology Team shall be contacted for assistance in generating an MSDS if required.</li></ul>

## 8.0 Documentation

### 8.1 CHP-Specific Records and Record Keeping

Documentation of implementation shall include the record keeping specified in LIR 402-510-01, "Chemical Management," and the additional records specified below:

#### 8.1.1 Industrial Hygiene and Safety Group

The Industrial Hygiene and Safety Group shall maintain the Laboratory's CHP and Category I list.

#### 8.1.2 Occurrence Investigation Group

The Occurrence Investigation Group shall maintain accident and incident reports.

**Guidance Note:** Other documentation may include cases of lost workdays resulting from a job-related exposure or accident, worker exposure complaints and suspected exposures, safety suggestions from workers, near-miss reports, repair and maintenance records, and accident/incident investigations and outcomes.

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## 9.0 References

ACGIH (American Conference of Governmental Industrial Hygienists) 1997. "1997 TLVs and BEIs," Cincinnati, Ohio.

American Chemical Society, 1996, "Chemical Risk: A Primer" (<http://www.acs.org.80/eig-crprimer.html>).

ANSI (American National Standards Institute) 1990. "American National Standard for Emergency Eyewash and Shower Equipment," ANSI Z385.1, New York, New York.

ANSI 1998. "American National Standard Institute Material Safety Data Sheets—Preparation," ANSI Z400.1, New York, New York.

Bretherick, L., 1990. "Bretherick's Handbook of Reactive Chemical Hazards," Fourth Edition, Butterworth & Co. (Publishers) Ltd.

Dufour, J. T., et al., 1990. "Hazard Communication Handbook," California Chamber of Commerce.

Kingsley, W. K., E. B. Segal, R. Phifer, 1998. "Living with the Laboratory Standard: A Guide for Chemical Hygiene Officers," American Chemical Society Committee on Chemical Safety, Washington, DC.

LANL (Los Alamos National Laboratory). "General Waste Management Requirements," Laboratory document LIR 404-00-02, most recent edition, Los Alamos, New Mexico.

National Research Council 1995. "Prudent Practices in the Laboratory: Handling and Disposal of Chemicals," Washington, DC.

OSHA (Occupational Safety and Health Administration). "Occupational Exposure to Hazardous Chemicals in Laboratories," 29 CFR 1910.1450, most recent edition, Washington, DC.

Young, J. A., W. K. Kingsley, and G. H. Wahl, Jr., 1990. "Developing a Chemical Hygiene Plan," American Chemical Society, Washington, DC.

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## ATTACHMENT 2

### HAZARD COMMUNICATION PLAN

#### 1.0 Introduction

This attachment states the requirements that shall be implemented for the Laboratory's "Hazard Communication Plan" (HAZCOM Plan). It defines the minimum set of requirements that shall be adhered to for implementing the Hazard Communication Standard (29 CFR 1910.1200, "General Industry," or 29 CFR 1926.59, "Construction").

#### 2.0 Scope and Applicability

This HAZCOM Plan shall apply to any chemical that is known to be present in the workplace to an extent that employees or subcontractors may be exposed under normal conditions of use or in a predictable emergency. It shall apply to production facilities and to locations in which

- commercial products are made;
- routine operations are conducted (such as solvent cleaning);
- chemicals are used for product preparation (such as a dip tank or painting operation);
- personnel are engaged in construction, facility work, or maintenance; and/or
- chemical residues are present (such as those being cleaned up under the Environmental Restoration and Decontamination and Decommissioning programs).

Any routine operations in which more than 50% of the work (e.g., detonator production, pit production, maintenance and construction, photographic development, and mechanical shops) involves a finite list of hazardous compounds must meet the provisions of this attachment. This plan covers the requirements that shall be implemented for maintaining material safety data sheets (MSDSs), lists of hazardous chemicals, medical surveillance, and requirements for training workers on the hazards of the chemicals with which they work.

"Occupational Exposures to Hazardous Chemicals in Laboratories," 29 CFR 1910.1450, shall apply to (1) laboratories engaged in laboratory-scale work when multiple chemical procedures or chemicals are used, (2) the analytic procedures are not part of a production process nor in any way simulate a production process, and (3) "protective laboratory practices and equipment" are available and in common use to minimize the potential for exposure to hazardous chemicals. (See Attachment 1, "Chemical Hygiene Plan.")

#### 3.0 Definitions

##### 3.1 Acronyms

ACIS	Automated Chemical Inventory System
AHA	Activity hazard analysis
PS	Health, Safety, and Radiation (Division)
FOM	Field Operations Manual (Industrial Hygiene and Safety Group)
HAZCOM	Hazard communication
HCP	Hazard control plan
MSDS	Material data safety sheet
OSHA	Occupational Safety and Health Administration
PPE	Personal protective equipment

##### 3.2 Terms

**Hazard control plan**—A document that records the review of an operation that (1) identifies hazards present in the operation, (2) develops solutions that eliminate unacceptable risks, and (3) describes how an operation is to be safely performed in accordance with integrated safety management.

**Original container**—A chemical container bearing the original label as received from a manufacturer or distributor.

**Portable container**—Any chemical container that will be used only by the person who puts chemicals into the container and the contents of which will be used entirely in a single workday.

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**Secondary container**—Any chemical container other than an original container that will be used by more than one person or will be used beyond a single workday.

## 4.0 Responsibilities

The elements of the HAZCOM Plan that shall be implemented and the responsible individual or organization are described in Table 2-1.

**TABLE 2-1**

### **RESPONSIBILITIES INVOLVED IN MANAGING HAZARDOUS CHEMICALS**

<b>Individual or Organization</b>	<b>Shall</b>
<b>Safety- and Environment-Responsible Line Managers</b>	<ul style="list-style-type: none"><li>• Ensure that the inventory of tracked chemicals purchased or produced is current on ACIS and that a hard copy is available to workers by operation/location. (ACIS fulfills this requirement.)</li><li>• Maintain MSDSs in an accessible form for all hazardous chemicals present in the workplace. (Electronic MSDSs are available at <a href="http://int/lanl.gov/safety/chemical/index.shtml">http://int/lanl.gov/safety/chemical/index.shtml</a>)</li><li>• Ensure that procedures are in place to inform employees of the hazards of nonroutine tasks.</li><li>• Prepare MSDSs for chemicals that are produced for use by other facilities or organizations (see Table 2-2).</li><li>• Ensure that containers meet labeling requirements and that the labeling system is explained to workers (see Attachment 4).</li><li>• Determine (with assistance from an ESH qualified person) the control measures that are to be implemented and the PPE that is to be used for operations involving hazardous chemicals.</li><li>• Ensure adherence to prescribed restrictions for use of conditionally approved engineering controls (see Attachment 10).</li><li>• Ensure that required PPE is available and used when required (see Attachment 9).</li><li>• Ensure that workers have received site-specific or job-specific training as needed and that employees are authorized to work with all of the chemicals they handle.</li><li>• If carcinogens are used, shall ensure the Carcinogen Management Program (Attachment 3) is implemented.</li><li>• Ensure that chemicals do not exceed storage limits (see Attachments 6 and 7).</li><li>• Determine a disposal plan for shock-sensitive and peroxide-forming compounds and document in the HCP (see Attachment 5).</li><li>• Segregate incompatible chemicals (see Attachment 5).</li></ul>
<b>Qualified Chemical Worker</b>	<ul style="list-style-type: none"><li>• Follow the HAZCOM Plan and the required HCP, AHA, or equivalent manuals or procedures for the chemicals to be used.</li><li>• Report immediately to the safety-and-environmentally-responsible line managers and FMs all accidents, spills, and leaks that could result in occupational exposure, illness, or injury.</li><li>• Maintain PPE in a clean and ready-to-use condition and wear PPE when required.</li><li>• Identify containers requiring labeling and implement Attachment 4 requirements.</li><li>• Attend required training.</li></ul>

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<b>Occupational Medicine Group</b>	<ul style="list-style-type: none"> <li>• Provide annual medical surveillance for participating chemical workers.</li> <li>• Report to safety-and-environmentally-responsible managers and to the Industrial Hygiene and Safety Group all cases of employee exposure.</li> </ul>
<b>ESH Qualified Person</b>	<ul style="list-style-type: none"> <li>• Conduct workplace evaluations using calibrated and maintained equipment in accordance with Industrial Hygiene and Safety Group's LIHSM procedures (<a href="http://int.lanl.gov/safety/lihsm/">http://int.lanl.gov/safety/lihsm/</a>). If exposure is monitored, report sampling data results to the safety-and-environmentally-responsible line managers, to Occupational Medicine, and to Industrial Hygiene and Safety.</li> <li>• Assist operating groups in evaluating the effectiveness of control measures.</li> </ul>
<b>PS Division Training Group</b>	<ul style="list-style-type: none"> <li>• Provide introductory HAZCOM training.</li> </ul>

## 5.0 LANL Hazard Communication Standard Requirements

Many of the general requirements shall be covered by ACIS, the on-line MSDS database, and training supplied by HSR Division's Training Group. Each organization to which the above OSHA standard applies must implement the activity-specific requirements below, which may exist in either facility-level or activity-level documents, such as AHAs, HCPs, and operating procedures. Table 2-2 lists the topics that shall be included in the HAZCOM Plan, as well as the minimum requirements of the Chemical Management Program under each topic.

**TABLE 2-2**  
**MINIMUM FACILITY-SPECIFIC**  
**HAZARD COMMUNICATION REQUIREMENTS**

<b>Topic</b>	<b>Minimum Requirements Shall Be</b>
<b>Written Program</b>	<ul style="list-style-type: none"> <li>• Identification of how labeling, MSDS, and employee information and training requirements shall be met (see Attachment 4).</li> <li>• Maintenance of chemical inventory on ACIS.</li> <li>• A list of specific information and training requirements for workers.</li> <li>• A maintained list of hazardous chemicals known to be present at the work location, including laboratory-produced chemicals.</li> <li>• Identification of the methods that shall be used to inform employees of the chemical hazards of nonroutine tasks.</li> <li>• An explanation of how workers of other employers will be informed of precautions and labeling and how the workers will have access to MSDSs.</li> </ul>
<b>Labels and Other Forms of Warning</b>	<ul style="list-style-type: none"> <li>• Marking each container of hazardous chemicals leaving the workplace with the identity of the hazardous chemicals, appropriate hazard warnings, and the name and address of the chemical manufacturer (see Attachment 4 and LIR 405-10-01, "Packaging and Transportation").</li> <li>• Immediately replacing any manufacturer's labels that have been removed or defaced.</li> <li>• Ensuring that labels remain legible and displayed in a prominent place.</li> <li>• Labeling secondary containers, (not the same as secondary containment) as required, unless they are used immediately by the employee performing the transfer (see Attachment 4).</li> <li>• Changing labels to reflect new hazard data, if the data are available to the owner.</li> </ul>
<b>Material Safety Data Sheets</b>	<ul style="list-style-type: none"> <li>• Keeping a copy of the MSDS for each hazardous chemical in a workplace location that is readily available to employees during each work shift. (Electronic copies of MSDSs are available at <a href="http://www.int.lanl.gov/safety/chemical/index.html">http://www.int.lanl.gov/safety/chemical/index.html</a>).</li> <li>• Generating MSDSs for laboratory-produced materials used by other facilities or organizations whenever the composition of the chemical substance contains a hazardous chemical. Whenever a mixture is formed, the MSDSs developed must include the chemical composition when a hazardous chemical exceeds 1% (0.1% for carcinogens). The Industrial Hygiene and Safety Group's Toxicology Team shall be contacted for assistance in generating an MSDS.</li> </ul>

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<b>Information and Training</b>	<ul style="list-style-type: none"><li>• Informing employees of the<ul style="list-style-type: none"><li>- requirements of the HAZCOM Plan,</li><li>- operations in their areas when hazardous chemicals are present, and</li><li>- location and availability of the written program, including chemical lists and MSDS files.</li></ul></li><li>• Training employees on<ul style="list-style-type: none"><li>- hazardous chemicals in their workplaces at the time of initial assignment and whenever new hazards are introduced,</li><li>- methods that shall be used to detect the presence or release of hazardous chemicals,</li><li>- physical and health hazards of chemicals in the workplace, measures employees can implement to protect themselves from these hazards, and</li><li>- details of the Laboratory's HAZCOM Program, including an explanation of the labeling system, MSDSs, and how employees obtain hazard information.</li></ul></li></ul> <p><b>Note:</b> HAZCOM training provided by the PS Division Training Group covers the general requirements for training. Each group need only supply training on workplace-specific hazardous chemicals.</p>
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## 6.0 Required Records

Official record and document maintenance shall be the responsibility of the parties identified in Table 2-3.

**TABLE 2-3**

### RECORD-KEEPING REQUIREMENTS

Individual or Organization	Shall
<b>Safety and Environment-Responsible Line Managers</b>	<ul style="list-style-type: none"><li>• Maintain current chemical inventory on ACIS.</li><li>• Implement current hazard analysis documentation such as AHAs, SOPs, or HCP(s) that are referenced by the HAZCOM Plan.</li></ul>
<b>Occupational Medicine Group</b>	<ul style="list-style-type: none"><li>• Maintain medical consultation, medical examination, and medical surveillance records.</li></ul>
<b>Industrial Hygiene and Safety Group</b>	<ul style="list-style-type: none"><li>• Keep performance testing records for control measures (e.g., tests performed on hoods and respirators).</li><li>• Maintain LANL's "Hazard Communication Plan."</li></ul>

## 7.0 References

ANSI 1998. "American National Standard Material Safety Data Sheets—Preparation," ANSI Z400.1, New York, New York.

OSHA (Occupational Safety and Health Administration). "Hazard Communication Standard," 29 CFR 1910.1200, most recent edition, Washington, DC.

OSHA (Occupational Safety and Health Administration). "Hazard Communication Standard," 29 CFR 1926.59, Construction, most recent edition, Washington, DC.

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## ATTACHMENT 3

### CARCINOGEN MANAGEMENT

#### 1.0 Introduction

The Laboratory shall maintain a Carcinogen Control Program, which involves identifying, evaluating, and controlling occupational exposures to chemical carcinogens. This document describes the requirements and steps that shall be required to ensure implementation of these requirements.

#### 2.0 Purpose

The Laboratory's Carcinogen Control Program shall be designed to meet the requirements of the Occupational Safety and Health Administration's (OSHA's) specific chemical standards.

#### 3.0 Scope

The Laboratory's Chemical Hygiene Plan (Attachment 1) or this attachment shall govern work areas in which carcinogens are used. All Laboratory operations that are identified by safety-and-environmentally-responsible line managers as governed by the Hazard Communication Standard and that use, generate, or store chemicals identified as known or suspected human carcinogens by the American Conference of Governmental Industrial Hygienists (ACGIH) or OSHA shall be subject to the requirements.

**Guidance Note:** The carcinogen list is presented on the chemical management web page (<http://int.lanl.gov/safety/chemical/index.shtml>) and clicking on "Reference Lists".

The Industrial Hygiene and Safety Group's Carcinogen Program coordinator shall be consulted in determining a material's carcinogen status since MSDSs may not accurately indicate carcinogen status, particularly when a carcinogen is grouped with other potential hazards. A general exception shall be use of consumer products (Section 4, "Definitions"). Additionally, naturally occurring materials shall be exempt unless they are used or stored expressly for research and development activities.

#### 4.0 Definitions

##### 4.1 Acronyms

ACGIH	American Conference of Governmental Industrial Hygienists
ACIS	Automated Chemical Inventory System
CAS	Chemical Abstract Service
CHP	Chemical hygiene plan
DOE	US Department of Energy
ES&H	Environment, safety, and health
HSR	Health, Safety, and Radiation (Division)
FOM	Field Operations Manual (Industrial Hygiene and Safety Group)
HCP	Hazard control plan
LIG	Laboratory implementation guidance
MSDS	Material safety data sheet
OSHA	Occupational Health and Safety Administration
PPE	Personal protective equipment

##### 4.2 Terms

**Authorized personnel**—Those employees whose safety-and-environmentally-responsible line managers have provided the information and training for the hazards of a particular operation or process and have been granted permission by those line managers to perform the work.

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**Carcinogens**—Chemicals identified by the following agencies, which have a concentration equal to or greater than one-tenth of one percent [0.1%; 1,000 parts per million (1,000 ppm)]:

- ACGIH
  - Category A1 confirmed human carcinogen.
  - Category A2 suspected human carcinogen.
- OSHA

**Guidance Note:** Only OSHA- and ACGIH-identified carcinogens are subject to the requirements of this attachment. The following are three additional sources of information for establishing a chemical as a carcinogen or a potential carcinogen:

- International Agency for Research on Cancer. "Monographs," most recent editions.
  - Group 1 confirmed human carcinogen.
  - Group 2A probable human carcinogen.
  - Group 2B possible human carcinogen.
- National Toxicology Program. "Annual Report on Carcinogens," most recent edition.
  - materials known to be carcinogenic.
  - materials that may reasonably be expected to be carcinogens.

**Consumer product**—A product used in the workplace in a manner and quantity consistent with its use by the general public.

**Guidance Note:** Examples of consumer products that may contain carcinogens are spray paints, spray finishes, and spray adhesives.

**Information**—ES&H reference material made available and easily accessible to employees.

**Medical surveillance**—A medical exam and laboratory and diagnostic testing that evaluates exposure to specific carcinogens.

**Regulated area**—A space used for work involving LANL-regulated carcinogens or carcinogens that an ESH qualified person has determined to present a high or moderate potential hazard. It shall be restricted and controlled.

## 5.0 Responsibilities

Individual or Organization	Shall
Group Leader/ Immediate Supervisor	<ul style="list-style-type: none"><li>• Identify employees who may be exposed to carcinogens in the course of their work.</li><li>• Maintain required records (see Section 7).</li><li>• Ensure that the identified qualified chemical workers have received facility-specific or job-specific training as needed and that the employees are authorized for work with carcinogens.</li><li>• Ensure that approved, current HCPs exist for the carcinogens to be used by his/her personnel or in his/her facility space(s) and that HCP provisions are implemented.</li><li>• Ensure that ventilation performance meets minimum requirements before beginning any new operation(s) involving carcinogens.</li><li>• Report to the group leader, immediate supervisor, and ESH qualified person the qualified chemical workers and the carcinogens used or stored.</li><li>• Report to the qualified chemical workers the outcome of the ESH qualified person's evaluations of carcinogen use and the results of carcinogen use sampling data.</li><li>• Maintain a current carcinogen inventory, including chemical names, CAS numbers, quantities, and locations, including room number.</li></ul>

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	<p><b>Guidance Note:</b> The carcinogen inventory may be a subset of a chemical inventory as long as the carcinogens are specifically identified.</p> <ul style="list-style-type: none"> <li>Request that the ESH qualified person reevaluate the carcinogen use hazard potential when the use of a carcinogen changes in quantity, concentration, frequency, or duration.</li> </ul>
<b>ESH Qualified Person</b>	<ul style="list-style-type: none"> <li>Identify unreported carcinogens through facility walk-throughs and reviews of documents such as HCPs and chemical purchase records.</li> <li>Suggest less hazardous, noncarcinogenic substitutes for currently used carcinogens when compatible with the work to be accomplished.</li> <li>Evaluate all reported carcinogen use. (See the Industrial Hygiene and Safety Group's LIHSM at <a href="http://int.lanl.gov/safety/lihsm/">http://int.lanl.gov/safety/lihsm/</a>).</li> <li>Report to the Occupational Medicine Group all qualified chemical workers and registered (evaluated) carcinogens; include recommendations regarding workers participation in the Carcinogen Medical Surveillance Program.</li> <li>Obtain sampling data using calibrated and maintained equipment for operations or processes involving carcinogens that are OSHA-regulated or have a high- or moderate-hazard potential (i.e., an increased likelihood for employee exposure).</li> <li>Report sampling data results to the group leader and immediate supervisor and to Occupational Medicine.</li> <li>Assist operating groups in evaluating the effectiveness of control measures.</li> <li>Test local exhaust ventilation systems using calibrated and maintained equipment according to the "Performance Testing Procedure: Local Exhaust Ventilation Systems" in the Industrial Hygiene and Safety Group's LIHSM. (<a href="http://int.lanl.gov/safety/lihsm/">http://int.lanl.gov/safety/lihsm/</a>)</li> <li>Upon request, provide training assistance, information, and advice relating to carcinogen use.</li> <li>Provide copies of all required records (see Section 7) to the Industrial Hygiene and Safety Group's Carcinogen Program coordinator.</li> </ul>
<b>Occupational Medicine Group</b>	<ul style="list-style-type: none"> <li>Provide carcinogen medical surveillance for participating employees.</li> <li>Maintain a database of qualified chemical workers who have been identified as participants in the Medical Carcinogen Surveillance Program.</li> <li>Request additional investigation by the ESH qualified person if either physician or patient has concerns about carcinogen use.</li> <li>Report to the group leader and to the Industrial Hygiene and Safety Group all cases of employee exposure.</li> </ul>
<b>Qualified Chemical Worker</b>	<ul style="list-style-type: none"> <li>Implement the operating group's HCP(s) for the carcinogens it uses.</li> <li>Assist the ESH qualified person to ensure that valid and representative sampling data are collected.</li> <li>Participate in the Medical Carcinogen Surveillance Program.</li> <li>Report immediately to the group leader and immediate supervisor all accidents, including occupational injuries and illnesses, possible exposures, spills, and leaks.</li> <li>Maintain PPE in a clean and ready-to-use condition and wear PPE when required. At a minimum, employees shall wear a long-sleeved lab coat, eye protection, and chemically resistive gloves when working with carcinogens. See Attachment 9 for additional information.</li> </ul>
<b>Industrial Hygiene and Safety Group</b>	<ul style="list-style-type: none"> <li>Update the carcinogen list annually.</li> </ul>

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## 6.0 Requirements

### 6.1 General Requirements

When any carcinogen identified by OSHA or ACGIH is used, generated, or stored (refer to <http://int.lanl.gov/safety/chemical/index.shtml>) the following requirements shall be met:

- The Industrial Hygiene and Safety Group must be notified of the names of qualified chemical workers working with carcinogens, the chemical names and size of the chemical containers, the location of use, and the location of storage. For this purpose, for each carcinogen in the inventory, Form 1600 shall be obtained from the Industrial Hygiene and Safety Group, the upper half shall be completed, and it shall be mailed to the address provided on the form, which is located at the end of this attachment.
- Qualified chemical workers must have received required training and must be authorized by group leader/immediate supervisor for work with carcinogens.
- A regulated area must be assigned for carcinogen work and storage. Regulated areas may overlap with other work or storage areas, but access must be controlled either by administrative or by physical means. If OSHA has published a standard for a specific carcinogen, the requirements for that standard shall be implemented; contact the ESH qualified person for details.
- An inventory of carcinogens must be maintained.
- All areas in which carcinogens are used or stored must be clearly marked by posting signs warning of a carcinogen hazard. Eating, drinking, smoking, or applying of cosmetics or lip balm shall not be allowed in these areas. (See LIG 402-100-01, "Signs, Labels, Tags" for hazard warning and control signs.)
- Additional signs and labels shall be required when OSHA-regulated carcinogens are in use. The carcinogen list is posted on the Chemical Management web page. (Go to <http://int.lanl.gov/safety/chemical/index.shtml> and click on Reference Lists.)
- All materials containing 0.1% or more of a listed carcinogen must be clearly labeled to warn of a carcinogen hazard.
- Employees who work with carcinogens must know accident and spill response requirements.
- After initial carcinogen use has been evaluated, the names of qualified chemical workers who are assigned to work with carcinogens must be reported to the Industrial Hygiene and Safety Group.

**Guidance Note:** This report may be accomplished by memorandum, a telephone call, or by indicating the employees on Industrial Hygiene and Safety Group quarterly update reports, whichever is more timely. A reevaluation of carcinogen use is not necessary unless the usage has been or will be changed.

### 6.2 Evaluation-Dependent Requirements

If the Industrial Hygiene and Safety Group's qualified person's evaluation of carcinogen use results in a moderate- or high-hazard-potential rating (for definitions, see the Carcinogens section in the Industrial Hygiene and Safety Group's Laboratory Industrial Hygiene and Safety Manual, <http://int.lanl.gov/safety/lihsm/>), then the following additional requirements shall be met:

- A regulated area must be assigned for carcinogen work and storage. Regulated areas may overlap with other work or storage areas, but access to such areas must be controlled either by administrative or physical means.
- An approved, current HCP must be on record.
- Decontamination procedures for ultimately restoring equipment and facilities to uncontrolled use must be known before new carcinogens are used. These procedures shall be described in the HCP.

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## 6.3 Medical Surveillance

Enrolling an employee in the Medical Carcinogen Surveillance Program shall be based on

- known exposure to a carcinogen, as documented by carcinogen use sampling data obtained by the ESH qualified person;
- presumed exposure until carcinogen use sampling data are acquired by an ESH qualified person; or
- voluntary participation.

As part of evaluating carcinogen use, the ESH qualified person shall make a recommendation about medical surveillance for each identified employee. The decision shall be transmitted by memorandum to the group leader and immediate supervisor and to Occupational Medicine. A qualified chemical worker who is participating in medical surveillance because of a regulatory requirement or because of known exposure to a carcinogen shall remain enrolled until the end of his/her Laboratory employment, even if carcinogen use ceases.

## 7.0 Required Records

Individual or Organization	Shall Maintain
Group Leader/ Immediate Supervisor	<ul style="list-style-type: none"><li>• A current carcinogen inventory (may be in a computer database or on paper).</li><li>• Documentation that is relevant to qualified chemical workers' job-specific training.</li><li>• Any approved, current HCP(s) describing carcinogen use.</li><li>• Completed carcinogen use forms (Form 1600 at the end of this attachment), one for each carcinogen in use.</li><li>• Carcinogen use evaluation memoranda from the ESH qualified person, with completed carcinogen use forms attached.</li><li>• Carcinogen use reporting memoranda from the ESH qualified person (sent when evaluation of the carcinogen in use or storage is not required).</li><li>• Carcinogen use sampling data results memoranda from the ESH qualified person, if sampling was performed.</li><li>• Additional qualified chemical workers using carcinogens memoranda from the ESH qualified person, if workers are assigned to previously evaluated and unchanged carcinogen work.</li></ul>
Industrial Hygiene and Safety Group	<ul style="list-style-type: none"><li>• This attachment and the carcinogen list.</li><li>• A database of carcinogens in use or storage at the Laboratory.</li><li>• Copies of completed carcinogen use forms, one for each carcinogen in use, filed by operating group.</li><li>• Copies of carcinogen use evaluation memoranda sent to group leader and immediate supervisor.</li><li>• Copies of carcinogen use reporting memoranda sent to group leader and immediate supervisor.</li><li>• Employee- and workplace-exposure-monitoring (sampling) records.</li><li>• Copies of carcinogen use sampling data results memoranda sent to group leader and immediate supervisor.</li><li>• Copies of additional employees using carcinogens memoranda sent to group leader and immediate supervisor.</li><li>• Copies of performance-testing records for control measures.</li></ul>
Occupational Medicine Group	<ul style="list-style-type: none"><li>• Occupational Medicine shall maintain carcinogen medical surveillance records.</li></ul>

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## 8.0 References

ACGIH (American Conference of Governmental Industrial Hygienists) 1997. "1997 TLVs and BEIs," Cincinnati, Ohio.

California Proposition 65. (1986), "The Safe Drinking Water and Toxic Enforcement Act of 1986."

<http://www.oehha.org/prop65/p65.htm> .

Los Alamos National Laboratory, current edition. "The Laboratory Institutional Health and Safety Manual [click here](#)."

International Agency for Research on Cancer. "Monographs," most recent editions.

Los Alamos National Laboratory document LIG 402-100-01, "Signs, Labels, and Tags."

National Toxicology Program (NTP), "Annual Report on Carcinogens."

OSHA (Occupational Safety and Health Administration). "Toxic and Hazardous Substances," 29 CFR 1910.1001–1050, Subpart Z, Washington, DC.

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## CARCINOGEN USE

(One form per carcinogen; to be completed by operating group)

Requested by		Z Number	Date
Telephone Number	Mail Stop	Group Leader	
Group	Technical Area	Building	Room(s)
Carcinogen Name			
CAS Number		Quantity	
Storage Location		Location of Use	
Description of Process			
Description of Available or Planned Engineering Controls and Protective Clothing			

### Provide attachments as needed

Please provide the name and Z number of other personnel who may have contact with this carcinogen, using the back of this form.

**RETURN FORM TO:** Carcinogen Control Program, Industrial Hygiene and Safety Group, HSR-5, Mail Stop K494

*For assistance, contact Industrial Hygiene Field Support (665-4427)*

### HAZARD POTENTIAL DETERMINATION

(To be completed in consultation with HSR-5)

Type of Carcinogen <input type="checkbox"/> Known Human <input type="checkbox"/> Suspected Human <input type="checkbox"/> Experimental Animal <input type="checkbox"/> Other _____			
Route(s) of Exposure <input type="checkbox"/> Inhalation <input type="checkbox"/> Absorption (Skin) <input type="checkbox"/> Ingestion <input type="checkbox"/> Other _____			Exposure Limit PEL/TLV: _____
Quantity Used	Concentration Used	Frequency of Use	Duration of Use
Other Information			
Mitigating Work Practices <input type="checkbox"/> Safety Glasses <input type="checkbox"/> Gloves <input type="checkbox"/> Lab Coat <input type="checkbox"/> Other _____			
Engineering Controls <input type="checkbox"/> Local Exhaust Hood <input type="checkbox"/> Other _____			
Hazard Potential <input type="checkbox"/> High <input type="checkbox"/> Moderate <input type="checkbox"/> Low			Evaluated By
Medical Surveillance? <input type="checkbox"/> Yes <input type="checkbox"/> No			Signature
Medical Surveillance Reason <input type="checkbox"/> Mandatory <input type="checkbox"/> Exposure Hazard <input type="checkbox"/> Voluntary			Date
Regulatory Program <input type="checkbox"/> 5480.10(c) / HazCom <input type="checkbox"/> CHP		Standard Operating Procedure Required? <input type="checkbox"/> Yes <input type="checkbox"/> No	HSR-5 SOP Control Number
Requirements/Recommendations			

Form 1600 (3/94)

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## ATTACHMENT 4

### SIGNS AND LABELING

#### 1.0 Introduction

All containers of hazardous chemicals shall be labeled in English. Containers shall include original containers; secondary containers; tanks; cylinders; portable containers; and apparatus, equipment, and containers holding laboratory-produced materials. Containers that bear a laboratory-produced chemical hazards warning label shall meet this requirement. The Industrial Hygiene and Safety Group, HSR-5, shall be contacted for preprinted labels. A laboratory-produced material shall be a chemical or chemical mixture created by an operating group at the Laboratory. Included shall be synthesized chemicals and chemical mixtures that are maintained or stored for more than one day and that are intended for continual or repetitive use in a laboratory or for distribution to other laboratories or users.

The following materials shall be exempted from the labeling requirements of this document:

- pesticides;
- food, food additives, color additives, drugs, and cosmetics, including materials intended for use as ingredients in such products;
- consumer products;
- wood and wood products; and
- articles.

#### 2.0 Original Containers

Original container labels shall not be removed or defaced if they still accurately define the contents. Labels on original containers that are currently in controlled-access storage areas and that do not contain the required information shall be labeled when the container is removed for use. The name on the container must be the same as the name on the material safety data sheet (MSDS).

Original (manufacturing) container labels shall indicate

- name(s) or trade name(s) of the hazardous chemical(s),
- health and physical hazard warnings, including target organs, and
- name and address of the manufacturer or distributor.

#### 3.0 Secondary Containers

In areas governed by hazard communication (HAZCOM) plans, secondary container labels shall include

- the name of the owner,
- the name(s) of the hazardous chemical(s),
- health and physical hazard warnings, and
- if the contents include an Occupational Safety and Health Administration- (OSHA-) regulated carcinogen, the words "Danger" and "Carcinogen Hazard."

**Guidance Note:** Preprinted labels are available from the Industrial Hygiene and Safety Group for many common chemicals. The term "secondary containers" is not the same as "secondary containment."

In areas governed by a chemical hygiene plan (CHP), secondary container labels shall include

- the owner and
- the contents of the container.

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## • 3.1 Alternative Labeling Methods for Secondary Containers

In areas where multiple small vials/containers are in use, the alternative methods below shall meet the requirements:

- labeling a rack or tray holding containers with the information required or
- coding containers and placing the required information in the hazard analysis documentation, posting the required information in the work area (such as on the glove box containing the material), or referring the worker to the MSDS for hazard information.

The owner of the containers and chemical work must be identified on the label.

## 4.0 Portable Containers

In areas governed by HAZCOM plans only, a portable container is one that shall be used for less than a single shift by the person who obtained the chemical. Labels on portable containers shall indicate the name(s) of the hazardous chemical(s) and the chemical's owner.

## 5.0 Posting Requirements

Signs must be posted in areas where hazardous materials are present. Acquisition and display of hazard warning and control signs shall be as described in LIR 402-100-01 and LIG 402-100-01, "Signs, Labels, and Tags." Additional signs and labels shall be required when OSHA-regulated carcinogens are in use. ([Click here for sign catalog.](#))

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## ATTACHMENT 5 STORAGE INCOMPATIBILITY AND INSTABILITY

### Introduction

The following tables shall be used to assist in storing chemicals.

**Guidance Note:** The following web sites may be useful: The US Coast Guard Cargo Compatibility Chart can be found at [http://tis.eh.doe.gov/web/chem\\_safety/Docs/compat.pdf](http://tis.eh.doe.gov/web/chem_safety/Docs/compat.pdf).

The University of Nebraska-Lincoln Compatibility Chart of Chemical Mixtures can be found at <http://www.unl.edu/enviro/hazard/compchrt.htm>.

Table 5-1 provides specific chemical compatibility and incompatibility guidelines that shall be used for determining a segregation plan and Table 5-2 lists unstable chemicals. Each chemical owner's safety-and-environmentally-responsible line manager shall determine the disposal plan for shock-sensitive and peroxide-forming compounds. The disposal plan shall be documented in the HCP.

Storage shall include bulk, tank, piping, cylinder, and container storage of solid, liquid, or gaseous chemicals and shall include used and unused chemicals, laboratory-produced materials, those stored in partially filled containers and in containers other than original container, and chemical "heels" (residues) left in tanks, piping, or containers. (See DOE Chemical Safety Web Page at [http://tis-hq.eh.doe.gov/web/chem\\_safety/](http://tis-hq.eh.doe.gov/web/chem_safety/).)

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TABLE 5-1	
SPECIFIC INCOMPATIBLE CHEMICALS/COMPOUNDS	
Chemical	Is Incompatible with...
Acetic acid	Chromic acid, nitric acid, hydroxyl compounds, ethylene glycol, perchloric acid, peroxides, permanganates
Acetylene	Chlorine, bromine, copper, fluorine, silver, mercury
Acetone	Concentrated nitric and sulfuric acid mixtures
Alkali and alkaline earth metals	Water, carbon tetrachloride or other chlorinated hydrocarbons, carbon dioxide, halogens
Ammonia (anhydrous)	Mercury, chlorine, calcium hypochlorite, iodine, bromine, hydrofluoric acid (anhydrous)
Ammonium nitrate	Acids, powdered metals, flammable liquids, chlorates, nitrates, sulfur, finely divided organic or combustible materials
Aniline	Nitric acid, hydrogen peroxide
Arsenical materials	Any reducing agent
Azides	Acids
Bromine	See Chlorine
Calcium oxide	Water
Carbon (activated)	Calcium hypochlorite, all oxidizing agents
Carbon tetrachloride	Sodium
Chlorates	Ammonium salts, acids, powdered metals, sulfur, finely divided organic or combustible materials
Chromic acid and chromium trioxide	Acetic acid, naphthalene, camphor, glycerol, alcohol, flammable liquids in general
Chlorine	Ammonia, acetylene, butadiene, methane, propane (or other petroleum gases), hydrogen, sodium carbide, benzene, finely divided metals, turpentine
Chlorine dioxide	Ammonia, methane, phosphine, hydrogen sulfide
Copper	Acetylene, hydrogen peroxide
Cumene hydroperoxide	Acids (organic or inorganic)
Cyanides	Acids
Flammable liquids	Ammonium nitrate, chromic acid, hydrogen peroxide, nitric acid, sodium peroxide, halogens
Fluorine	Everything
Hydrocarbons (butane, etc.)	Fluorine, chlorine, bromine, chromic acid, sodium peroxide
Hydrocyanic acid	Nitric acid, alkali
Hydrofluoric acid (anhydrous)	Ammonia (aqueous or anhydrous)
Hydrogen peroxide	Copper, chromium, iron, most metals and their salts, alcohols, acetone, organic materials aniline, nitromethane, combustible materials
Hydrogen sulfide	Fuming nitric acid, oxidizing gases
Hypochlorites	Acids, activated carbon
Iodine	Acetylene, ammonia (aqueous or anhydrous), hydrogen

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TABLE 5-1	
SPECIFIC INCOMPATIBLE CHEMICALS/COMPOUNDS	
Chemical	Is Incompatible with...
Mercury	Acetylene, fulminic acid, ammonia
Nitrates	Sulfuric acid
Nitric acid (concentrated)	Acetic acid, aniline, chromic acid, hydrocyanic acid, hydrogen sulfide, flammable liquids and gases, copper, brass, and heavy metals
Nitrites	Acids
Nitroparaffins	Inorganic bases, amines
Oxalic acid	Silver, mercury
Oxygen	Oils, grease, hydrogen, flammable liquids, solids, and gases
Perchloric acid	Acetic anhydride, bismuth and its alloys, alcohol, paper, wood, grease, oils
Peroxides, organic	Acids (organic or mineral). Avoid friction; store cold.
Phosphorus (white)	Air, oxygen, alkalies, reducing agents
Phosphorus pentoxide	Water
Potassium	Carbon tetrachloride, carbon dioxide, water
Potassium chlorate	Sulfuric and other acids
Potassium perchlorate	Sulfuric and other acids
Potassium permanganate	Glycerol, ethylene glycol, benzaldehyde, sulfuric acid
Selenides	Reducing agents
Silver	Acetylene, oxalic acid, tartaric acid, ammonium compounds, fulminic acid
Sodium	Carbon tetrachloride, carbon dioxide, water
Sodium nitrate	Ammonium nitrate and other ammonium salts
Sodium peroxide	Ethyl or methyl alcohol, glacial acetic acid, acetic anhydride, benzaldehyde, carbon disulfide, glycerin, ethylene glycol, ethyl acetate, methyl acetate, furfural
Sulfides	Acids
Sulfuric acid	Potassium chlorate, potassium perchlorate, potassium permanganate (similar compounds of light metals, such as sodium, lithium)
Tellurides	Reducing agents

Source: American Chemical Society, 1992. Chemical Safety Manual for Small Business, Second Edition.

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**TABLE 5-2**  
**PRUDENT PRACTICES FOR DISPOSING OF CHEMICALS FROM LABORATORIES**

<b>LIST A</b>	
Severe peroxide hazard on storage with exposure to air. Check for exposure to air or <b>discard within 3 months.</b>	
<b>Name</b>	<b>CAS</b>
Divinyl ether	109-93-3
Diisopropyl ether (isopropyl ether)	108-20-3
Divinylacetylene <sup>a</sup>	821-08-9
Potassium metal	7440-09-7
Potassium amide	17242-52-3
Sodium amide (sodamide)	7782-92-5
Vinylidene chloride (1,1-dichloroethylene) <sup>a</sup>	75-35-4
<b>LIST B</b>	
Peroxide hazard on concentration; do not distill or evaporate without first testing for the presence of peroxides. <b>Discard or test for peroxides after 6 months.</b>	
<b>Name</b>	<b>CAS</b>
Acetaldehyde diethyl acetal (acetal)	105-57-7
Cumene (isopropylbenzene)	98-82-3
Cyclohexene	110-83-8
Cyclopentene	142-29-0
Cyclooctene	931-88-4
Decalin (decahydronaphthalene)	91-17-8
Diacetylene (butadiene)	106-99-0
Dicyclopentadiene	77-73-6
Diethyl ether (ether)	60-29-7
Diethylene glycol dimethyl ether (diglyme)	111-96-6
Dioxane (p-dioxane)	123-91-1
Ethylene glycol dimethyl ether (glyme)	629-14-1
Ethylene glycol ether acetates	—
Ethylene glycol monoethers (cellosolves)	—
Furan	110-00-9
Methylacetylene	74-99-7
Methylcyclopentane	96-37-7
Methyl isobutyl ketone	108-10-1
Tetrahydrofuran	109-99-9
Tetralin (tetrahydronaphthalene)	119-64-2
Vinyl ethers <sup>a</sup>	—
<b>LIST C</b>	
Hazard of rapid polymerization initiated by internally formed peroxides. <sup>a</sup>	
<b>1. Normal liquids; discard or test for peroxides after 6 months.<sup>b</sup></b>	
<b>Name</b>	<b>CAS</b>
Acrylic acid	79-10-7
Acrylonitrile	107-13-1
Chloroprene (2-chloro-1,3-butadiene) <sup>c</sup>	126-99-8
Chlorotrifluoroethylene	79-38-9
Methyl methacrylate	80-62-6
Styrene	100-42-5
Vinyl acetate	108-05-4
Vinylidene chloride	75-35-4
Vinylpyridine	—
<b>2. Normal gases; discard after 12 months.<sup>b</sup></b>	
<b>Name</b>	<b>CAS</b>
Butadiene <sup>c</sup>	106-99-0
Tetrafluoroethylene <sup>c</sup>	116-14-3
Vinylacetylene <sup>c</sup>	689-97-4
Vinyl chloride	75-01-4

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- a. Polymerizable monomers should be stored with a polymerization inhibitor from which the monomer can be separated by distillation just before use.
- b. Although air will not enter a gas cylinder in which gases are stored under pressure, these gases are sometimes transferred from the original cylinder to another in the laboratory, and it is difficult to be sure that there is no residual air in the receiving cylinder. An inhibitor shall be put into any such secondary cylinder before one of these gases is transferred into it; the supplier can suggest inhibitors to be used. The hazard posed by these gases is much greater if there is a liquid phase in such a secondary container, and even inhibited gases that have been put into a secondary container under conditions that create a liquid phase shall be discarded within 12 months.
- c. The hazard from peroxides in these compounds is substantially greater when they are stored in the liquid phase, and, if so stored without inhibitors, they shall be treated under the guidelines in List A.

Source: National Research Council, 1995. "Prudent Practices in the Laboratory: Handling and Disposal of Chemicals," p. 56.

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## ATTACHMENT 6

### STORING AND USING FLAMMABLE AND COMBUSTIBLE LIQUIDS

#### 1.0 Introduction

Because of the condensed nature of this document, any special circumstances or operations concerning storing and using flammable and combustible liquids must be brought to the attention of the ESH qualified person or Fire Protection Group personnel.

#### 2.0 Definitions

##### 2.1 Acronyms

DOT	US Department of Transportation
HSR	Health, Safety, and Radiation (Division)
HAZCOM	Hazard communication
HVAC	Heating, ventilating, and air conditioning
IBC	Intermediate bulk container
NFPA	National Fire Protection Association
OSHA	Occupational Safety and Health Administration
UL	Underwriters' Laboratories

##### 2.2 Terms

**Boiling Point**—The temperature at which the vapor pressure of a liquid equals the surrounding atmospheric pressure.

**Combustible liquid**—A liquid that has a flash point at or above 100°F. Combustible liquids are classified as Class II or Class III, as follows:

**Class II Liquid**—Any liquid that has a flash point at or above 100°F and below 140°F.

**Class IIIA Liquid**—Any liquid that has a flash point at or above 140°F and below 200°F.

**Class IIIB Liquid**—Any liquid that has a flash point above 200°F.

**Fire area**—An area of a building completely enclosed by fire-resistant construction of at least 1 hr (although greater resistance may be required) and having all communicating openings protected by an assembly having a fire resistance rating of at least 1 hr.

**Flammable liquid**—Any liquid that has a flash point at or below 100°F. Flammable liquids are classified as Class I as follows:

**Class IA Liquid**—Any liquid that has a flash point below 73°F and a boiling point below 100°F.

**Class IB Liquid**—Any liquid that has a flash point below 73°F and a boiling point at or above 100°F.

**Class IC Liquid**—Any liquid that has a flash point at or above 73°F but below 100°F.

**Flammable liquid storage cabinet**—A cabinet for storing flammable and combustible liquids that has been listed and approved by a UL-listed laboratory or has been constructed in accordance with the requirements of Section 4-3 of NFPA 30.

**Flash point**—The minimum temperature at which a liquid gives off vapor in sufficient concentration to form an ignitable mixture when combined with air near the surface of the liquid or within the vessel used.

**Hazardous material storage locker**—A moveable, prefabricated structure intended to meet local, state, and federal requirements for storing hazardous materials outside. These lockers must include a spill containment system to prevent the flow of liquids from the structure under emergency conditions.

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**Incidental liquid use or storage**—Use or storage of flammable and combustible liquids subordinate to the purpose for which the occupancy or area classification was established.

**Industrial facility**—Occupancies and properties devoted to operations such as processing, assembling, mixing, packaging, finishing, producing, and repairing.

**Inside liquid storage area**—A room or building used for storing liquids in containers or portable tanks that is separated from other types of occupancies.

**Laboratory work area**—From a fire protection engineering perspective (see NFPA 45), a room or space for testing, analysis, research, instruction, or similar activities that involve the use of chemicals.

**Laboratory unit**—From a fire protection engineering perspective (see NFPA 45), an enclosed space used for experiments or tests.

**Safety can**—A portable container of not more than 5 gal. capacity with self-closing valved openings (e.g., spring-closing lid and spout cover), designed so that it will safely relieve internal pressure when exposed to fire, and approved by a UL-listed laboratory.

## 3.0 Sizes and Types of Containers

Table 6-1, which incorporates requirements from NFPA 30, NFPA 45, and OSHA regulations (29 CFR 1910.106), specifies the maximum size of containers that shall be approved for different classifications of liquids.

## 4.0 Storage and Use of Flammable and Combustible Liquids

### 4.1 Storage Cabinets, Lockers, and Refrigerators and Freezers

Cabinets and lockers for storing flammable and combustible liquids shall be subject to strict design, construction, and performance standards. Approved cabinets and lockers shall be purchased from the Laboratory's scientific supply contractor or from vendors only if they meet the requirements stated in Table 6-1.

#### 4.1.1 Flammable Liquid Storage Cabinets

Flammable liquid storage cabinets shall be those listed and approved by a UL-listed and -approved laboratory and shall display a label that reads "Flammable—Keep Fire Away" or similar warning and are typically constructed entirely of steel and designed for storing flammable and combustible liquids in individual containers not exceeding 55 gal. Unless otherwise specifically listed and approved, flammable liquid storage cabinets shall be for indoor use only.

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TABLE 6-1

## MAXIMUM ALLOWABLE SIZE OF CONTAINERS AND PORTABLE TANKS

Liquids  Container Type	Flammable Liquids			Combustible Liquids	
	Class IA	Class IB	Class IC	Class II	Class III
Glass	1 pt <sup>a</sup> [500 ml]	1 qt <sup>a</sup> [1 L]	1 gal. [4 L]	1 gal. [4 L]	1 gal. [4 L]
Metal [other than Department of Transportation (DOT) drum] or approved plastic	1 gal. [4 L]	5 gal. [20 L]	5 gal. [20 L]	5 gal. [20 L]	5 gal. [20 L]
Safety Cans	2.5 gal. [10 L]	5 gal. [20 L]	5 gal. [20 L]	5 gal. [20 L]	5 gal. [20 L]
Metal Drum (DOT specifications) Laboratories Only	NP <sup>b</sup>	5 gal. [20 L]	5 gal. [20 L]	60 gal. [227 L]	60 gal. [227 L]
Metal Drum (DOT specifications) Nonlaboratories	60 gal. [227 L]	60 gal. [227 L]	60 gal. [227 L]	60 gal. [227 L]	60 gal. [227 L]
Approved Metal Portable Tanks and Intermediate Bulk Containers (IBCs)	660 gal.	660 gal.	660 gal.	660 gal.	660 gal.
Rigid Plastic IBC (UN 31H1 or 31H2) and Composite IBC (UN 31HZ1)	NP <sup>c</sup>	NP <sup>c</sup>	NP <sup>c</sup>	660 gal.	660 gal.
Polyethylene DOT Specification 34, UN 1H1	1 gal. [4 L]	5 gal. [20 L]	5 gal. [20 L]	60 gal. [227 L]	60 gal. [227 L]
Fiber Drum (NMFC or UFC Type 2A; Types 3A, 3B-H, or 3B-L; or Type 4A)	NP <sup>c</sup>	NP <sup>c</sup>	NP <sup>c</sup>	60 gal. [227 L]	60 gal. [227 L]
<p><b>a.</b> Class 1A and 1B liquids may be stored in glass containers of not more than 1-gal. capacity if the required purity (e.g., an American Chemical Society analytical reagent grade or higher) would be adversely affected by storage in a metal or an approved plastic container or if the liquid would cause excessive corrosion or degradation of a metal or an approved plastic container.</p>					
<p><b>b.</b> NP = Not permitted. Exception: Drums of not more than 60-gal. capacity of Class IA liquids may be stored in a separate area inside a building if the inside storage area meets the requirements of NFPA 30 and 29 CFR 1910.106.</p>					
<p><b>c.</b> NP = Not permitted.</p>					

Not more than three flammable liquid storage cabinets shall be installed in any one fire area. See Section 4.3.3 for exceptions in industrial facilities.

Flammable liquid storage cabinets shall not obstruct corridors, aisles, or exit doors and shall not be located in exit enclosures.

**Guidance Note:** Although flammable liquid storage cabinets are provided with vent openings, such cabinets need not be vented for fire protection purposes.

Cabinet vent openings shall be sealed with the metal bungs provided with the cabinets by the manufacturer. If the cabinet is to be vented for any reason, it shall be vented directly to the outdoors away from windows, HVAC intakes, and means of egress, and in such a manner that the vents will not compromise the specified performance of the cabinet.

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Flammable liquid storage cabinets are listed/approved for storage capacities up to 120 gallon and of the total listed/approved capacity, no more than 50% of the storage capacity shall be Class I and Class II liquids.

## 4.1.2 Hazardous Material Storage Lockers for Outdoor Use

When hazardous material lockers must be located outdoors, they shall be approved units. (For the purposes of this LIR, "approved" means approved by one of the following: UL, Factory Mutual Research, Omega Point Laboratories, National Institute of Science and Technology, and Research Council of Canada.) These lockers shall include a spill containment system to prevent the flow of liquids from the lockers under emergency conditions. The containment systems shall have sufficient capacity to contain 10% of the total volume of the containers allowed or the volume of the largest individual container, whichever is greater and generally do not exceed 1,500 ft<sup>2</sup> in size.

Consideration shall be given to environmental parameters that may compromise outdoor storage of specific flammable and combustible liquids.

**Guidance Note:** Lockers exposed to direct sunlight may be exposed to temperatures that are excessively high for volatile liquids. During the winter months, exposure to freezing temperatures may occur.

## 4.1.3 Refrigerators and Freezers

Refrigerators and freezers used to store flammable liquids shall be one of three types: commercially available "explosion-proof" models, commercially available "laboratory-safe" or "explosion-safe" models, or modified domestic models. Explosion-proof refrigerators and freezers shall be designed to protect against ignition of flammable vapors both inside and outside the refrigerated storage compartment.

**Guidance Note:** Laboratory-safe and explosion-safe refrigerators and freezers incorporate design features such as thresholds, self-closing doors, friction latches, and magnetic door gaskets to protect against ignition of flammable vapors. In addition, the compressor and control circuitry are located on the top of these units to reduce the possibility of igniting floor-level flammable vapors.

All refrigerators and freezers used in laboratories shall be clearly marked to indicate whether they are safe for storing flammable liquids.

**Guidance Note:** Manually defrosted domestic refrigerators and freezers can be used to store flammable liquids if they are modified as follows:

- All electrical equipment located within the outer shell, within the storage compartment, on the door, or on the door frame meets the requirements for Class I, Division 1, locations as described in Article 501 of the National Electrical Code (NFPA 70).
- Electrical equipment is mounted on the outside of the storage compartment in one of the following ways:
  - in a manner that meets the requirements for Class I, Division 2, locations, as described in Article 502 of the National Electrical Code (NFPA 70),
  - be installed above the storage compartment, or
  - be installed on the outside surface of the equipment where exposure to hazardous concentrations of vapors is minimal.
- The manual temperature controls is relocated to the exterior of the storage compartment, and all points where capillary tubing or wiring enters the storage compartment shall be sealed.
- The light switches and light assemblies are removed and the resulting openings shall be sealed.
- Positive mechanical door latches are replaced with magnetic door gaskets.

## 4.1.4 Storing Incompatible Liquids and Chemicals

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To prevent storage of incompatible materials in the same cabinet, only flammable and combustible liquids shall be stored in flammable cabinets. Incompatible liquids and chemicals shall not be stored in the same cabinet, locker, refrigerator, or freezer.

**Guidance Note:** For small quantities of incompatible items, commingled storage in the same storage cabinet is acceptable, provided that each individual container has the required secondary containment. (Small containers of like type can be clustered in a single tray.)

## 4.2 Inside Storage Rooms

When quantities of flammable and combustible liquids are expected to exceed the limitations specified in Section 4.3, these liquids shall be stored in rooms or facilities that meet the requirements of NFPA 30 and 29 CFR 1910.106. Dedicated flammable and combustible liquid storage rooms shall be designed and constructed in accordance with the requirements of NFPA 30. These storage rooms shall not be provided in belowgrade areas (e.g., basements). The Fire Protection Group shall be consulted at the time such rooms are designed and constructed.

## 4.3 Quantity Limitations

### 4.3.1 Office and Administrative Areas

Storage of flammable and combustible liquids in office and administrative areas shall be limited to that required for operating and maintaining office equipment or other office use. Flammable and combustible liquids in office areas must be kept in closed metal containers and stored in a storage cabinet, safety can, or inside storage room that does not have a door that opens into the portion of the building used for communal activities.

### 4.3.2 Laboratories

Limitations on the quantities of flammable and combustible liquids in laboratories shall be based on a hazard classification of the individual laboratory unit (see definition in Section 2) and available fire protection features. The maximum quantities of Class I liquids when combined with Class II and IIIA liquids shall not exceed the maximum quantities specified for Class I liquids alone. Limitations on container size that shall apply are provided in Table 6-1.

**Guidance Note:** A laboratory unit can include offices, lavatories, other incidental contiguous rooms maintained for or used by laboratory personnel, and corridors within the unit. It can include room or space for testing, analysis, research, instruction, or similar activities that involve the use of chemicals. This work area can be enclosed. Laboratory units are typically separated from adjacent nonlaboratory areas or other laboratory units by noncombustible or fire-resistant construction, depending on the hazards present. A laboratory unit can contain one or more laboratory work areas. It can be an entire building. Tables 6-2 and 6-3, taken from NFPA 45, provide the basis for laboratory unit hazard classification and allowable quantities of flammable and combustible liquids. In Tables 6-2 and 6-3, Class I liquids include Class I flammable liquids and liquefied flammable gases.

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TABLE 6-2

**MAXIMUM QUANTITIES OF FLAMMABLE AND COMBUSTIBLE LIQUIDS STORED  
IN LABORATORY UNITS PROVIDED WITH AUTOMATIC FIRE  
SPRINKLER PROTECTION SHALL BE:**

		<i>Excluding</i> Quantities in Storage Cabinets or Safety Cans		<i>Including</i> Quantities in Storage Cabinets and Safety Cans	
Laboratory Unit Hazard Classifica-tion	Flammable or Com-bustible Liquid Class	Maximum Quantity per 100 ft <sup>2</sup> of Total Lab Unit (gal.)	Maximum Quantity (Total) per Lab Unit (gal.)	Maximum Quantity per 100 ft <sup>2</sup> of Total Lab Unit (gal.)	Maximum Quantity (Total) per Lab Unit (gal.)
A	I	10	600	20	1,200
	I, II, and IIIA	20	800	40	1,600
B	I	5	300	10	600
	I, II, and IIIA	10	400	20	800
C	I	2	150	4	300
	I, II, and IIIA	4	200	8	400
D	I	1.1	75	2	150
	I, II, and IIIA	1.1	75	2	150

The primary factor in determining the fire hazard classification of the laboratory unit shall be the quantity of flammable and combustible liquids present. To ensure that required fire protection features are provided in the design and construction of a new laboratory or in the modification of an existing laboratory, the Fire Protection Group shall be consulted to assist in determining a laboratory unit fire hazard classification. This classification, in turn, shall determine the automatic fire sprinkler protection and other fire protection features (e.g., fire-resistive separation) required to mitigate the hazards the unit presents to occupants and adjacent areas.

Flammable and combustible liquids stored in the open (outside a flammable liquid storage cabinet) in the laboratory work area shall be kept to the minimum required for the work to be accomplished.

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TABLE 6-3

**MAXIMUM QUANTITIES OF FLAMMABLE AND COMBUSTIBLE LIQUIDS STORED IN LABORATORY UNITS WITHOUT AUTOMATIC FIRE SPRINKLER PROTECTION SHALL BE:**

		<i>Excluding Quantities in Storage Cabinets or Safety Cans</i>		<i>Including Quantities in Storage Cabinets and Safety Cans</i>	
Laboratory Unit Hazard Classification	Flammable or Combustible Liquid Class	Maximum Quantity per 100 ft <sup>2</sup> of total Lab Unit (gal.)	Maximum Quantity (Total) per Lab Unit (gal.)	Maximum Quantity per 100 ft <sup>2</sup> of total Lab Unit (gal.)	Maximum Quantity (Total) per Lab Unit (gal.)
A	I	10	300	20	600
	I, II, and IIIA	20	400	40	800
B	I	5	150	10	300
	I, II, and IIIA	10	200	20	400
C	I	2	75	4	150
	I, II, and IIIA	4	100	8	200
D	I	1.1	37	2	75
	I, II, and IIIA	1.1	37	2	75

## 4.3.3 Industrial Facilities

Non-process-related flammable and combustible liquids located outside flammable liquid storage cabinets shall be limited to 1 day's supply in a single fire area. The aggregate sum of non-process-related flammable and combustible liquids located outside of flammable liquid storage cabinets or inside storage rooms in a single fire area shall not exceed the sum of

- 25 gal. of Class IA flammable liquids in containers;
- 120 gal. of Classes IB, IC, II, or III liquids in containers;
- 2 portable tanks, neither of which exceeds 660 gal. of Classes IB, IC, II, or IIIA liquids; or
- 20 portable tanks, none of which exceeds 660 gal. of Class IIIB liquids.

When more than 3 flammable liquid storage cabinets will be located in the same fire area, a minimum separation of 100 ft shall be maintained between groups of not more than 3 cabinets. When the facility is provided with automatic sprinkler protection, the number of cabinets that shall be authorized in any one cabinet group is 6.

## 4.3.4 Other Occupancies and Incidental Use Areas

Flammable and combustible liquids located outside flammable liquid storage cabinets shall be limited to 1 day's supply in a single fire area. The quantity of Class I, II, and III liquids in containers outside flammable liquid storage cabinets shall not exceed 25 gal. in containers in a single fire area. If an area is unique or requires special evaluation and consideration, the Fire Protection Group shall be consulted.

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## 4.3.5 Outdoor Storage Areas

Flammable and combustible liquids stored outdoors shall be located in approved cabinets or lockers or in containers or portable tanks in accordance with Table 6-4. Table 6-4, provides the limits and requirements that shall be implemented for outdoor storage of flammable and combustible liquids. When two or more classes of liquids are stored in a single pile, the maximum gallonage in that pile shall be the smallest of two or more separate liquid class gallonages. The Fire Protection Group shall be contacted if assistance in developing outdoor storage areas is required.

**TABLE 6-4**

**THE MAXIMUM OUTDOOR FLAMMABLE AND COMBUSTIBLE LIQUID STORAGE  
IN CONTAINERS AND PORTABLE TANKS SHALL BE:**

Liquid Class		IA	IB	IC	II	III
Containers	Quantity (gal.)	1,100	2,200	4,400	8,800	22,000
	Maximum per Pile	10	12	12	12	18
Rigid Plastic and Composite IBC	Quantity (gal.)	--	--	--	8,800	22,000
	Maximum per Pile	--	--	--	12	18
Portable Tanks and Metal IBC	Quantity (gal.)	2,200	4,400	8,800	17,000	44,000
	Maximum per Pile	7	14	14	14	14
	Distance Between Piles (ft)	5	5	5	5	5
	Distance to Protected Exposures (ft)	50	50	50	25	10
	Distance to Street, Road, or Alley (ft)	10	10	10	5	5

## 4.4 Use and Handling of Flammable and Combustible Liquids

### 4.4.1 General Requirements for Dispensing and Transferring Liquids

Labeling must be accomplished in accordance with HAZCOM requirements. See Attachment 4 for details.

Class I, Class II, or Class III liquids that are heated up to or above their flash points shall be drawn from

- original shipping containers with a capacity of no more than 5 gal. and
- from safety cans

and shall be transferred to vessels, containers, or portable tanks by one of the following methods:

- through a closed piping system,
- by means of a device that has antisiphoning protection and that draws through the top of the container when portable tanks or containers are involved, or
- by gravity through a listed self-closing valve or self-closing faucet.

When liquids are dispensed from drums, the drums shall be equipped with a UL-listed and -approved dispensing device. When liquids are transferred between conductive containers, the containers shall be bonded with a wire. The bonding wire or one of the containers shall be grounded.

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Transferring flammable and combustible liquids among vessels, containers, tanks, and piping systems by means of air or inert gas pressure shall be permitted only under the following conditions:

- when the vessels, containers, tanks, and piping systems are designed for such pressurized transfer and are capable of withstanding the anticipated operating pressure.
- when safety and operating controls, including pressure relief devices, are provided to prevent overpressurizing any part of the system.

Only inert gas shall be used to transfer Class I liquids and Class II and III liquids that are heated above their flash point.

## 4.4.2 Requirements for Dispensing and Transferring Liquids in Laboratories

Transferring Class I liquids to smaller containers from bulk stock containers not exceeding 5 gal. in capacity inside a laboratory work area shall be made

- in a laboratory hood,
- in an area provided with ventilation adequate to prevent accumulations of flammable vapor/air mixtures from exceeding 25% of the lower flammable limit, or
- inside liquid storage areas designed for dispensing Class I liquids meeting the requirements of NFPA 30 and 29 CFR 1910.106.

Transferring Class I liquids to smaller containers from bulk stock containers of 5 gal. or more in capacity shall be conducted in

- a separate area outside the building or
- inside liquid storage areas designed for dispensing Class I liquids that meet the requirements of NFPA 30 and 29 CFR 1910.106.

## 4.4.3 Ventilation

Required ventilation must be provided for all operations involving flammable and combustible liquids. In general, ventilation rates shall be sufficient to maintain the concentration of vapors in the area at or below 25% of the lower flammable limit (see NFPA 30 for details). When required, the ESH qualified person shall assist in defining ventilation parameters to prevent the build-up of toxic levels of vapors.

## 4.4.4 Disposal

Flammable and combustible liquids that are no longer needed or are not in active use must be disposed of safely as required by LIR 404-00-02, "General Waste Management Requirements," and LIR 404-00-03, "Hazardous and Mixed Waste Requirements for Generators."

## 5.0 Protecting Against Fire Hazards

### 5.1 Control of Ignition Sources

Precautions must be taken to prevent such activities and phenomena as the following from igniting flammable vapors:

- cutting, welding, and other hot work activities;
- electrical sparks;
- frictional heat or sparks;
- furnaces, ovens, and other heating appliances;
- hot surfaces;
- lightning;
- open flames;
- radiant heat;
- spontaneous ignition;
- static electricity; and

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- stray currents.

Smoking shall be permitted only in designated areas. Smoking shall be prohibited inside laboratory buildings or within 35 ft of flammable and combustible liquid storage or use.

## 5.2 Portable Fire Extinguishers

Class B or C portable fire extinguisher(s) shall be accessible and currently maintained in areas where flammable and combustible liquids are handled, stored, and used. Only trained workers shall use portable fire extinguishers; all other workers shall evacuate in case of a fire.

## 6.0 References

NFPA Standard No. 30, "Flammable and Combustible Liquids Code," most recent edition, Quincy, Massachusetts.

NFPA Standard No. 45, "Fire Protection for Laboratories Using Chemicals," most recent edition, Quincy, Massachusetts.

OSHA Standard No. 29 CFR 1910.106, "Flammable and Combustible Liquids," most recent edition, Washington DC.

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## ATTACHMENT 7

### USE AND STORAGE OF HAZARDOUS AND TOXIC GASES

#### 1.0 Introduction and Scope

This attachment specifies the requirements that shall be implemented for hazard labeling and storing compressed and liquefied gases in portable cylinders (volume at or about nominal 300 scf). See LIR 402-1200-01, "Pressure, Vacuum, and Cryogenic Systems," for the requirements that shall be implemented for acquiring, handling, using, and disposing of compressed and liquefied gases in cylinders.

Hazardous gases (toxic, flammable, oxidizing, pyrophoric, asphyxiating) can be handled safely if the required precautions are taken; thus, the requirements that shall be implemented to determine the precautions shall include those pertaining to the quantity, concentration, toxicity, reactivity, and pressure of the gas and the adequacy of engineering controls. An ESH qualified person must be contacted when operations involve hazardous gases so that possible exposures and the adequacy of controls can be evaluated. The Cryogenic and Liquefied Gas Safety Committee and the Pressure Vessel and Piping Committee (established in LIR 402-1200-01, "Pressure, Vacuum, and Cryogenic Systems") and the Industrial Hygiene and Safety Group shall be contacted for assistance in designing vessels and gas pressure systems. FSS-9 shall be contacted for assistance in evaluating vessels and gas pressure systems. The Fire Protection Group shall be contacted for assistance with fire-protection-related concerns pertaining to compressed and liquefied gas systems.

#### 2.0 Definitions

##### 2.1 Acronyms

ANSI	American National Standards Institute
ASME	American Society of Mechanical Engineers
DOT	US Department of Transportation
HSR	Health, Safety, and Radiation (Division)
NFPA	National Fire Protection Association

##### 2.2 Terms

**Compressed gas**—In general, a gas stored and used at pressures greater than nominal atmospheric pressure (14.7 psia at sea level and 11.3 psia in Los Alamos). Specific regulatory definitions include (1) a gas or mixture of gases having, in a container, an absolute pressure exceeding 40 psi at 70°F; (2) a gas or mixture of gases having, in a container, an absolute pressure exceeding 104 psi at 130°F, regardless of the pressure at 70°F; and (3) a liquid having a vapor pressure exceeding 40 psi at 100°F.

**Flammable gas**—A gas that is flammable at atmospheric temperature and pressure in a mixture of 13% or less (by volume) with air or that has a flammable range with air wider than 12%, regardless of the lower limit.

**Lecture bottle cylinder**—A small portable cylinder (approximately 2 in. x 13 in. [5 cm x 33 cm]).

**Liquefied gas**—A gas that can be maintained in the liquid state at room temperature by elevating the pressure. A gas, other than in solution, which, when contained under the charge pressure, exists both as a liquid and as a gas at a temperature of 68°F.

**NFPA Health Hazard Rating 4**—Materials that under emergency conditions can be lethal.

**NFPA Health Hazard Rating 3**—Materials that under emergency conditions can cause serious or permanent injury.

**NFPA Health Hazard Rating 2**—Materials that under emergency conditions can cause temporary incapacitation or residual injury.

**Oxidizing gas**—A gas that can support and accelerate combustion of other materials.

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**Portable cylinder**—A compressed gas container, fabricated to the specifications of or authorized for use by the DOT or fabricated according to the “Rules for the Construction of Unfired Pressure Vessels,” Section VIII, ASME Boiler & Pressure Vessel Code. DOT-specified cylinder sizes generally range from 5 in. in diameter x 32 in. in length (nominal 60 scf) to 9 in. in diameter x 55 in. in length (nominal 300 scf) in capacity.

**Pyrophoric gas**—A gas that spontaneously ignites in air at or below 130°F.

**Work area**—An indoor room or distinct space for testing, analysis, research, or similar activities that involve the use of chemicals.

## 3.0 Hazard Labeling

Compressed and liquefied gas cylinders containing hazardous gases shall be labeled with distinctive labels and signs that signify their contents, hazard warnings or target organ effects, and group ownership. When a gas is classified in more than one category, the most stringent labeling requirements shall be used. Gas distribution lines shall be labeled in accordance with ANSI A13.1, “Scheme for the Identification of Piping Systems.” The Compressed Gas Processing Center shall be contacted for assistance in obtaining required labels.

**Guidance Note:** Gas cylinders with Compressed Gas Processing Center labels meet the HAZCOM and CHP labeling requirements except for group ownership.

## 4.0 Limitations on Quantities

Cylinders that are not necessary for current work activities shall be stored in a safe location outside the work area. The total number of lecture bottle cylinders in a work area shall be limited to 25. The total quantity of portable compressed or liquefied gas cylinders containing hazardous materials or oxygen in use in a single work area shall not exceed the sum total of the limits of each of the three categories listed in Table 7-1.

## 5.0 Storage

The following storage requirements shall be observed:

- Storage areas for compressed and liquefied gas cylinders shall be dry, <125°F, well ventilated, away from direct sunlight, and preferably fire-resistive (see Table 7-2).
- Gas cylinders containing flammable, oxidizing, toxic, and other potentially incompatible gases shall be separated in accordance with Table 7-2. When a gas is classified in more than one category, all compatibilities shall be checked, and the most stringent separation requirements shall be used.

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TABLE 7-1

## QUANTITY LIMITATIONS FOR COMPRESSED AND LIQUEFIED GAS CYLINDERS SHALL BE:

		Maximum Number of Cylinders per 500 ft <sup>2</sup> of Total Work Area
Flammable or Oxidizing Gases	Automatic fire sprinkler protection in work space	6
	No automatic fire sprinkler protection in work space	3
Liquefied Flammable Gases	Automatic fire sprinkler protection in work space	3
	No automatic fire sprinkler protection in work space	2
Gases with Health Hazard Rating of 3 or 4	With or without fire sprinkler protection in work space	3

TABLE 7-2

## REQUIREMENTS FOR SEPARATION OF GAS CYLINDERS BY HAZARD SHALL BE:

Gas Hazard Category	Nonflammable	Oxidizing	Flammable	Pyrophoric	Toxic
Toxic	C <sup>a</sup>	20 ft <sup>b</sup>	20 ft	20 ft	--
Pyrophoric	C	20 ft	20 ft	--	20 ft
Flammable	C	20 ft	--	20 ft	20 ft
Oxidizing	C	--	20 ft	20 ft	20 ft
Nonflammable	--	C	C	C	C

a. C = compatible. No separation required.

b. The 20-ft separation requirement may be reduced without limit when the incompatible gases are separated by a barrier of noncombustible material(s) at least 5 ft high that has a fire-resistance rating of at least 30 min.

- Toxic or flammable gas cylinders shall not be installed or stored near windows, doors, or other openings to the work area(s).
- Toxic or flammable gas cylinders shall not be installed near ventilation intake ducts. The minimum separation shall be 30 ft.
- Cylinders of all gases having a NFPA health hazard rating of 3 or 4 and cylinders of gases having a NFPA health hazard rating of 2 and having no physiological warning properties shall be kept in a continuously mechanically ventilated hood or enclosure.
- Storage of toxic gases must be evaluated to ensure the safety of building occupants and the public. The ESH qualified person shall be contacted for assistance in identifying safe storage locations for toxic gases.
- Compressed gas regulators that are not in service shall be stored in plastic bags, and the labels shall indicate the gas they regulate.

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## 6.0 References

American Chemical Society, 1998. "Living with the Laboratory Standard: A Guide for Chemical Hygiene Officers," Washington, DC.

NFPA (National Fire Protection Association). "Fire Protection for Laboratories Using Chemicals," Standard No. 45, most recent edition, Quincy, Massachusetts.

NFPA (National Fire Protection Association). "Standard for the Storage, Use and Handling of Compressed and Liquefied Gases in Portable Cylinders," NFPA Standard No. 55, most recent edition, Quincy, Massachusetts.

NFPA (National Fire Protection Association). "Standard System for the Identification of the Hazardous Materials for Emergency Response," NFPA Standard No. 704, most recent edition, Quincy, Massachusetts.

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## ATTACHMENT 8

### SPILL CONTROL

#### 1.0 Introduction

A written spill response procedure shall be written for operations involving hazardous chemicals. The provisions in LANL's "Spill Prevention, Control and Countermeasures Plan" shall be implemented. Such procedures shall describe in detail the steps to be taken when a spill occurs and shall include such elements as staff responsibilities, communication methods, instructions on using spill response equipment, and spill cleanup and residue disposal. These procedures shall be communicated to all individuals who use chemicals or who might assist in cleaning up a spill. They shall be reviewed and updated periodically to ensure that all Laboratory workers are familiar with current information. Each procedure shall indicate the date it was last reviewed.

Spill response procedures shall include, as a minimum,

- a listing of required protective clothing, safety equipment, and cleanup materials required for cleaning up spills (gloves, respirators, etc.) and an explanation of their proper use;
- evacuation zones and procedures;
- availability of fire suppression equipment;
- disposal containers for spill cleanup materials; and
- first-aid procedures that might be required.

#### 2.0 Training

Qualified chemical workers who clean up their own spills shall be trained according to the "Hazard Communication Plan" (Attachment 2) or "Chemical Hygiene Plan" (Attachment 1). These plans shall require that all participants have been trained to use their personal protective equipment. Qualified chemical workers who go into other work areas to assist with spills must have documentation of additional, special training that includes how to handle the specific material spilled and how to approach accidents involving hazardous materials in unfamiliar locations.

#### 3.0 Handling Hazardous Wastes

Materials cleaned up from spills of hazardous substances shall be regulated as hazardous waste. Qualified chemical workers shall follow LIR 404-00-02, "General Waste Management Requirements," and LIR 404-00-04, "Hazardous and Mixed Waste Requirements for Generators," for packaging, labeling, and disposing of these materials.

#### 4.0 Distinguishing Between Simple and Complex Spills

When a spill occurs, personnel shall move well away from the area while determining the required response. There are two types of spills: simple spills (incidental release), which can be cleaned up by qualified chemical workers, and complex spills, which require outside assistance. A simple spill shall be defined as one that

- does not spread rapidly,
- does not endanger people or property, except by direct contact, and
- does not endanger the environment.

Three basic steps shall be taken to determine whether a spill is simple or complex: (1) evaluate the spill's risks, (2) estimate quantities, and (3) evaluate the spill's potential impact.

Potential health effects shall be the most important hazard category to consider when deciding whether to attempt to clean up a spill. Some chemical releases result in health hazards such as fires or explosions; others present health threats because of their ability to spread rapidly and enter the body readily, thus a spill shall not be considered "simple" if it presents the above risks.

#### 5.0 Seeking Outside Assistance

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If the potential for fire or explosion exists, personnel shall seek outside assistance from trained emergency responders (contact EM&R).

**Guidance Note:** Releases of flammable chemicals (liquid or solid) present significant fire and explosion risks when one or more of the following is present:

- volatile vapors,
- chemicals that react with water or with air,
- ignition sources,
- oxidizers, and
- significant quantities of combustible materials.

Other factors that magnify a spill's impact and require emergency response are

- the possibility that hazardous vapors or dusts will enter the building's ventilation system and be distributed to other areas;
- the possibility that spilled liquids will flow into other areas, thus expanding the threat of harm (e.g., the liquid might reach ignition sources, expose people outside the immediate operations area, or damage delicate equipment);
- the presence of incompatible chemicals;
- the proximity of conference rooms or offices containing people who could be harmed by the spill; and
- spills in sinks in the immediate operations area that might be connected to other sinks via the plumbing system.

If a respirator is needed for purposes other than radiological, outside assistance shall be requested. When any of the following conditions exist, outside help from emergency responders shall be requested (contact EM&R in accordance with LIR 403-00-01, "LANL Emergency Management Plan"):

- a confined space,
- the need for emergency medical attention,
- a fire,
- a natural gas leak,
- the need to shut off electricity,
- the need for evacuation,
- the need for traffic control, and
- the need for building security.

## 6.0 References

American Chemical Society, "Guide for Chemical Spill Response Planning in Laboratories,"  
<http://www.acs.org/govt/pubs/5st45d.htm>.

LANL (Los Alamos National Laboratory). "Emergency Management Plan," most recent edition.

LANL (Los Alamos National Laboratory), March 31, 1997. "Spill Prevention, Control, and Countermeasures Plan" (SPCC), Revision 4.

LANL (Los Alamos National Laboratory), "1998 Storm/Surface Water Pollution Prevention Best Management Practice Guidance Document."

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## ATTACHMENT 9

### PERSONAL PROTECTIVE EQUIPMENT

#### 1.0 Introduction

Personal protective equipment (PPE) shall be required in chemical work areas to protect the qualified chemical worker from hazards that are not mitigated by other means, hazards that are unknown, or hazards that are controlled but require extra protection. Operating procedures or HCPs shall include a description of the PPE to be used, its effectiveness for protecting against the hazard(s) of the operation, and its condition and cleanliness.

#### 2.0 Definitions

##### 2.1 Acronyms

HCP	Hazard control plan
MSDS	Material safety data sheet
PPE	Personal protective equipment

##### 2.2 Terms

**Degradation**—The tendency of glove material to swell, discolor, or change due to chemical contact.

**Permeation**—Refers to the time it takes a chemical to pass through a particular glove material.

#### 3.0 Responsibilities

Responsible Party	Shall
<b>Group Leader/Immediate Supervisor</b>	<ul style="list-style-type: none"><li>• evaluate each job task.</li><li>• consult with the ESH qualified person, select and require the use of PPE that will protect the worker from the identified hazards. The PPE must be designed to protect against the specific chemicals in use and must fit the user.</li><li>• identify qualified chemical workers who require respiratory protection for chemical work. Ensure that medical approvals are obtained for respiratory protection. Complete Form 1465, the Respiratory Protection Evaluation and Medical Approval for Personal Protective Equipment form.</li><li>• communicate selection decision to qualified chemical workers by means of the HCP or equivalent documentation.</li><li>• approve purchase of safety shoes and safety glasses.</li><li>• ensure that employees receive job-specific training on the purpose and use of the PPE selected.</li><li>• evaluate the effectiveness of PPE. Different equipment shall be necessary if<ul style="list-style-type: none"><li>- the equipment deteriorates rapidly with normal use or</li><li>- workers experience physical symptoms such as skin irritation.</li></ul></li><li>• ensure that an HCP is written for operations requiring respirators or protective clothing.</li><li>• document training requirements in qualified chemical worker training plans.</li></ul>
<b>Industrial Hygiene and Safety Group</b>	<ul style="list-style-type: none"><li>• approve purchases of all respirators.</li><li>• fit-test and train qualified chemical workers on respirator use.</li><li>• maintain the Respiratory Protection Program Plan.</li></ul>

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<b>ESH Qualified Person</b>	<ul style="list-style-type: none"><li>Assist immediate supervisor in selecting required PPE to protect workers against identified hazards. The manufacturer's test data on a specific chemical-protective material and the MSDS shall be consulted (electronic MSDSs are available at <a href="http://www.esh.lanl.gov/~esh5/">http://www.esh.lanl.gov/~esh5/</a>).</li></ul>
<b>Qualified Chemical Worker</b>	<ul style="list-style-type: none"><li>At a minimum, workers shall wear long-sleeved laboratory coats and eye protection when working with chemicals.</li><li>Be trained to know at least the following:<ul style="list-style-type: none"><li>the conditions in which PPE is required;</li><li>what kind of PPE is required;</li><li>how to put on, take off, adjust, and wear PPE;</li><li>the purpose of the PPE;</li><li>the limitations of the PPE; and</li><li>the required care, maintenance, useful life, and disposal of the PPE.</li></ul></li><li>Demonstrate an understanding of the training and his/her ability to use PPE as required before being authorized to perform work. Retraining shall be required whenever changes in the workplace or types of PPE to be used render previous training obsolete and whenever the immediate supervisor determines that a worker has not retained the requisite understanding or skill.</li></ul>

## 4.0 General Requirements

Below is a listing of PPE requirements that shall be implemented for general chemical work:

- PPE shall be stored in a clean, dry area at room temperature to prevent contamination and damage.
- Before use, the user shall visually inspect PPE to identify defects that may compromise effectiveness, such as imperfect seams, pinholes, tears, scratches, stiffness, and discoloration.
- PPE that is visibly damaged or contaminated shall not be used.
- LANL-approved prescription safety glasses or disposable safety spectacles shall be worn when working with chemicals and shall meet the most current requirements of ANSI Standard Z87.1. If there is danger of splashing chemicals or flying particles, goggles or other forms of eye protection that protect both the front and sides of the eyes shall be required. When working with more than 1,000 mL (1 liter) of a corrosive liquid, workers shall wear a face shield large enough to protect the chin, neck, ears, and face in addition to safety glasses/goggles. Protective glasses shall be worn when a worker is exposed to ultraviolet radiation or lasers.
- When working with corrosive liquids or allergenic, sensitizing, or toxic chemicals, workers shall wear gloves made of material known to be resistant to permeation by the chemical. Additional impermeable clothing shall be required when working around dip tanks.
- Qualified chemical workers shall always wear low-heeled shoes with fully covering uppers and shall not wear shoes with open toes or that have uppers constructed of woven material while working with hazardous chemicals.
- Whenever exposure by inhalation is likely to exceed the threshold limits described in MSDSs, a hood shall be used. If it is not possible to use a hood, the qualified chemical worker shall consult his/her immediate supervisor for additional requirements before doing any such work.
- When working with hazardous chemicals, workers' arms and legs must be covered and a long-sleeved lab coat shall be worn. Leg covering shall consist of long pants, scrubs, or other garments that completely cover the legs.

### 4.1 Glove Selection

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The following factors shall be considered in glove selection:

- Chemical resistance guides vary according to manufacturer; the information provided includes degradation and permeation; and chemicals can permeate a glove without causing visible change.
- All gloves are permeable. The time depends on the chemical handled and the composition, thickness, and condition of the glove. Permeation also depends on the extent and length of contact with the chemical and amount of hand/glove flexion.
- There is no ideal chemically resistant glove. Although some flexible laminate gloves (such as Silver Shield or 4H) offer protection against a wide range of hazardous chemicals, their potential limitations include diminished dexterity, tactile sensitivity, ability to grip when wet, and resistance to tears and punctures.
- Sometimes the "ideal" glove is two gloves worn together. Wearing one pair of gloves (such as reusable nitrile, latex, neoprene, butyl, or Viton) over a flexible laminate combines the advantages of both. When using this approach, the smallest laminate size that will fit comfortably shall be used, which allows the greatest dexterity when worn under the outer glove.
- Most chemical handling does not require immersion or prolonged contact. It is usually not necessary to replace heavy-duty (reusable) gloves as frequently as disposable gloves. Before reusable gloves are removed, they should thoroughly rinsed and allowed to air-dry. (Leather and polyvinyl alcohol gloves are water-permeable.) Reusable gloves should be replaced whenever they become discolored or show signs of damage. Reusable gloves suspected of having become contaminated should be replaced immediately. Contaminated gloves are hazardous waste.
- Disposable gloves are NOT suitable for use with hazardous or aggressive (corrosive or reactive) chemicals. Disposable gloves provide barrier protection only when the user is working with biological materials and radiological materials.

## 4.2 PPE Requirements for Carcinogens, Sharps, and Corrosives

Qualified chemical workers who handle chemical carcinogens shall wear a long-sleeved lab coat. If the lab coat becomes contaminated, it shall be laundered before reuse. Protective and/or chemically resistant gloves shall be worn by qualified chemical workers who engage in procedures in which skin contact with chemical carcinogens or Category I chemicals is likely or who handle sharp, rough objects or corrosive materials.

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TABLE 1

## GLOVE MATERIALS THAT SHALL BE CONSIDERED:

Material	Characteristic
Viton	Provides resistance to chlorinated and aromatic solvents.
Butyl	A good choice for aldehydes, ketones, and esters.
Neoprene	Provides resistance to a wide range of solvents, acids, caustics, and alcohols; offers tactility and dexterity without compromising chemical protection.
Nitrile	Affords a wide range of applications along with resistance to punctures and abrasions.
Natural Rubber (Latex)	Resists acids and bases. Often combined with other polymers for a broader range of applications. Caution: Workers may develop a latex allergy.
N-DEX™ Disposable Nitrile	Provides increased chemical resistance in a disposable glove and better puncture and tear resistance than disposable latex or polyvinyl chloride gloves. Is hypoallergenic and thus provides an alternative for latex-sensitive individuals.
Polyvinyl chloride	Resists acids but not petroleum solvents

## 5.0 References

Industrial Hygiene and Safety Group 1999. "Respiratory Protection Program Plan."

Dartmouth College, 1997. "Essential Information on the Selection and Use of Chemically Resistant Gloves in the Laboratory," Environmental Health and Safety Office, Hanover, New Hampshire.

Forsberg, K., with S. Z. Mansdorf, 1993. "Quick Selection Guide to Chemical Protective Clothing," Van Nostrand Reinhold, New York.

Johnson, J., and A. Schwope, 1991. "Guidelines for the Selection of Chemical Protective Clothing," Department of Energy, Office of Environment, Safety and Health, UCRL-ID-109106.

Los Alamos National Laboratory requirement AR 12-1, "Personal Protective Equipment."

OSHA (Occupational Safety and Health Administration). "Personal Protective Equipment," 29 CFR 1910, Subpart I, Washington, DC.

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## ATTACHMENT 10

### GENERAL REQUIREMENTS FOR HANDLING CHEMICALS

#### 1.0 Definitions

**Air cleaning**—A method of treating air to remove atmospheric dust and toxic, radioactive, and/or explosive materials.

**California hood**—Consists of a canopy-type hood to which two sides and a floor have been attached. Large horizontal sliding doors make up the other two sides.

**Contaminated sharps**—Any contaminated object that can penetrate the skin, including, but not limited to, needles, scalpels, broken glass, broken capillary tubes, and exposed ends of dental wires.

**Face velocity**—Average air velocity into the local exhaust ventilation system measured at the opening into the hood.

**Fume hood**—A ventilated enclosure designed to confine and exhaust odiferous, corrosive, and toxic vapors or fumes generated in the laboratory.

**Glove box**—A sealed enclosure (box) in which the operator handles all items using long rubber or neoprene gloves sealed to ports in the walls of the enclosure. The operators place their hands and forearms in the gloves from the room side of the box. Thus, although they are physically separated from the interior environment, they can manipulate items inside the box with relative freedom while viewing the operation through a window.

**Local exhaust ventilation system**—A ventilation system in which the contaminants are captured at their source.

**Sharps**—Sharps include hypodermic needles, syringes with and without needles, scalpel and Exacto knife blades, glass slides, razors, broken capillary tubes, Pasteur pipettes, and other broken glass.

#### 2.0 Emergency Shower and Eyewash

- Emergency shower and eyewash stations shall be provided within the work area for immediate emergency use when the eyes or body may be exposed to injurious, corrosive materials. In case of eye or skin contact, workers shall rinse with water for at least 15 minutes and then report to the Occupational Medicine Group for follow-up action. Eyewash and safety shower facilities must be within easy reach (10 seconds is recommended) and not more than 100 feet from the hazard in areas in which corrosive, flammable, or oxidizing chemicals are handled. The pathway to the eyewash and safety shower shall be unobstructed. Workers shall be trained on the location of the eyewash and safety shower in their work areas. These facilities shall be routinely inspected and tested to ensure proper functioning and to change the water in the pipes.

**Guidance Note:** A weekly eyewash test and annual (or more frequent) safety shower test are recommended to prevent biological growth.

- Records showing the date and time of testing and the status of the equipment shall be kept by the organization performing the test. A placard displayed nearby showing the date of the last test shall be sufficient. If the eyewash or safety shower fails the test, the facility manager and immediate safety-and-environmentally-responsible line manager shall be notified and must act to correct the problem.
- The ESH qualified person shall be contacted for emergency shower and eyewash design requirements.

#### 3.0 Ventilation

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General laboratory ventilation feeds into the local exhaust ventilation and breathing air systems; thus, it must not be relied upon for protection from toxic substances. Whenever practical, work with hazardous chemicals shall be performed in a chemical fume hood, glove box, or other ventilation device.

Airborne substances in workroom atmospheres must be kept below the threshold limit value or the permissible exposure limit, whichever is more stringent. Air-monitoring equipment with audible alarms, if commercially available, must be used when large volumes of hazardous chemical vapors or gases are handled.

## 3.1 Fume Hoods

It is the Laboratory's goal that all chemical fume hoods shall be equipped with airflow-monitoring devices. All new chemical fume hoods shall be equipped with airflow-monitoring devices. When existing chemical fume hoods are modified, airflow-monitoring devices shall be added to them. The environment-and-safety-responsible line manager shall determine the exact device in conjunction with the Industrial Hygiene and Safety Group or the ESH qualified person. The airflow-monitoring device must provide a visual and/or audible signal to alert personnel of inadequate airflow. The airflow-monitoring device shall be mounted so that it can be viewed and/or heard by personnel working at the hood.

**Guidance Note:** A magnehelic gage measuring the static pressure just downstream of the duct connection is considered to be the minimum acceptable device.

Hoods used for hazardous chemical operations shall contain only the hazardous chemicals and equipment used for current operations and shall not be used for storing equipment or other chemicals, including wastes.

All fume hoods shall be tested annually to verify that they meet minimum Laboratory performance requirements. These hoods shall bear one of the following labels:

- **Meets Requirements.** The hood meets face velocity and confinement requirements without limiting the maximum opening of the hood.
- **Conditionally Meets Requirements.** Some adjustments must be made to use the hood safely. Typically, this adjustment limits the maximum opening of the hood.
- **Does Not Meet Requirements.** Reasonable administrative controls will not improve the hood to perform as required. This condition is considered to be a system failure.

If any hoods do not meet the minimum requirements, the safety-and-environmentally-responsible line managers shall be notified, and they must act to correct the problem.

Qualified chemical workers must be trained to recognize the indicators of ineffective operation. If a ventilation system fails, workers shall shut down the activity, if practical, and close the hood sash, if applicable. If the activity cannot be shut down, the hood sash shall be closed and the workers shall leave, secure the area, and notify the required emergency and safety-and-environmentally-responsible personnel. Reentry into the area shall not be allowed until the hazards have been assessed and protective measures have been determined. The activity shall not be restarted until ventilation has been restored.

## 3.2 Exhaust Stacks

Each exhaust system used for controlling toxic or hazardous materials must have an exhaust stack that meets laboratory requirements. (Contact the Industrial Hygiene and Safety Group for more information.) The California hood generally shall be used only as a secondary control device because it generally does not provide the same level of protection as a conventional fume hood. The Industrial Hygiene and Safety Group shall review the purchase of local exhaust equipment before procurement. This review shall ensure that the required equipment is obtained. Air recirculation shall not be permitted in areas where toxic materials are used routinely.

## 4.0 Sharps

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All sharps shall be disposed in dedicated, hard-sided containers. Hypodermic needles and syringes shall not be bent, sheared, broken, or recapped, nor shall the needle be removed before disposal. Workers shall not attempt to tape up the sharp ends of these items, because the effort increases the risk of being cut.

The leak-proof, rigid, puncture-resistant sharps containers must be taped closed or tightly lidded to preclude any loss of contents.

Hard-sided sharps containers of all sizes and broken glass cardboard boxes can be obtained through the Laboratory's Just-in-Time vendors and most of these have the universal biohazard sign molded into the design of most of the container. If this type of container is used to dispose of uncontaminated sharps, the word "noninfectious" shall be marked on the container so that it is clear to all who come in contact with the container that it does not contain infectious waste.

**Guidance Note:** Sealed, hard-sided containers of uncontaminated sharps that are marked "noninfectious" may be disposed in solid waste dumpsters.

The requirements contained in LIR 402-530-00, "Biological Safety," shall be implemented when handling and disposal for infectious sharps.

## 5.0 Housekeeping

Housekeeping requirements shall be as follows:

- Materials that could cause such hazards as tripping, fire, explosion, or providing habitat for pests, shall not be allowed to accumulate in storage areas.
- Nothing shall be allowed to block access to emergency equipment, showers, eyewashes, or exits.
- All aisles, hallways, and stairs shall be kept clear of all chemicals.
- All chemicals shall be placed in their assigned storage areas at the end of each workday.
- At the end of each workday, all unlabeled containers shall be labeled in accordance with Attachment 4.
- Wastes shall be labeled and kept in their required containers.

## 6.0 Eating, Drinking, and Smoking

Eating (or putting any item in the mouth, such as a pencil eraser), drinking, smoking, or applying cosmetics or lip balm in laboratories containing chemicals, biological substances, or radioactive materials shall be prohibited. Glassware or utensils that have been used for laboratory operations shall not be used to prepare or consume food or beverages. Conversely, glassware and utensils actually used for food consumption shall not be used for laboratory operations.

## 7.0 Refrigerators and Microwave Ovens

All refrigerators and freezers shall be marked. Those used to store or prepare food shall be used only for that purpose and shall be labeled "Food only, no chemicals, no radioactive materials." Otherwise, they shall be labeled as "Chemical only, no food." ([Click here for sign catalog.](#)) Microwaves used for laboratory experiments shall be marked "Chemical only, no food."

## 8.0 References

ANSI (American National Standards Institute) 1990. "American National Standard for Emergency Eyewash and Shower Equipment," ANSI Z385.1, New York, New York.

Los Alamos National Laboratory requirement AR 8-3, "Ventilation."